DOCUMENT RESUME

ED 473 597 CE 084 511

TITLE	Achieving Excellence: Investing in People, Knowledge and Opportunity. Canada's Innovation Strategy.
ISBN	ISBN-0-662-31225-2
PUB DATE	2002-00-00
NOTE	95p.; Produced by Industry Canada. For the related "Knowledge Works ... " document, see CE 084 512. Also available in French under the title "Atteindre L'Excellence: Investir dans les Gens, la Savoir et la Possibilite".
AVAILABLE FROM	Information Distribution Centre, Communications and Marketing Branch, Industry Canada, Room 268D, West Tower, 235 Queen Street, Ottawa, ON K1A 0H5, Canada. Tel: 613-947-7466; Fax: 613-954-6436; e-mail: publications@ic.gc.ca; Web site: http://www.innovationstrategy.gc.ca Available in alternate formats upon request. For full text: http://www.innovationstrategy.gc.ca/ cmb/innovation.nsf/vRTF/PDF/$ file/achieving.pdf.
PUB TYPE	Opinion Papers (120)
EDRS PRICE	EDRS Price MF01/PC04 Plus Postage.
DESCRIPTORS	Academic Achievement; Adoption (Ideas); Adult Education; Community Development; Competition; Coordination; Developed Nations; *Economic Progress; Economics; Foreign Countries; Futures (of Society); *Innovation; *Labor Force Development; Motivation; Public Policy; *Research and Development; *Skills; Stimuli; Strategic Planning; Technological Advancement
IDENTIFIERS	*Canada

ABSTRACT

To become one of the world's most innovative countries, Canada requires a national innovation strategy for the 21st century. It is progressing toward a more innovative economy, but lags behind many developed countries in terms of overall innovation performance. A national innovation strategy to meet Canada's innovation challenge proposes goals, targets, and federal priorities in these three principal areas: knowledge performance, skills, and innovation environment. The public and private sectors in Canada need to address the knowledge performance challenge by creating and using knowledge strategically to benefit Canadians, i.e. promoting the creation, adoption, and commercialization of knowledge. To address the skills challenge, Canada must increase the supply of highly qualified people, thereby ensuring the supply of people who create and use knowledge. Canadians need increased confidence to adopt innovation. To meet the innovation environment challenge, Canada must work toward a better innovation environment; it must build an environment of trust and confidence, where the public interest is protected and market-place policies provide incentives to innovate. These three elements come together at the community level; Canada must stimulate creation of more clusters of innovation at the community level. The government must engage provincial and territorial governments and business and academic stakeholders to contribute to a national innovation strategy. (YLB)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 473 597

Government of Canada / Gouvernement du Canada

ACHIEVING EXCELLENCE

INVESTING IN PEOPLE, KNOWLEDGE AND OPPORTUNITY

CANADA'S INNOVATION STRATEGY

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☒ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

BEST COPY AVAILABLE

Canada

CE 084 511

ACHIEVING EXCELLENCE

INVESTING IN PEOPLE, KNOWLEDGE AND OPPORTUNITY

In the 21st century, our economic and social goals must be pursued hand-in-hand. Let the world see in Canada a society marked by innovation and inclusion, by excellence and justice.

The Right Honourable Jean Chrétien
Prime Minister of Canada
Reply to the Speech from the Throne, January 2001

CANADA'S INNOVATION STRATEGY

Canada's Innovation Strategy is presented in two papers. Both focus on what Canada must do to ensure equality of opportunity and economic innovation in the knowledge society.

Achieving Excellence: Investing in People, Knowledge and Opportunity recognizes the need to consider excellence as a strategic national asset. It focuses on how to strengthen our science and research capacity and on how to ensure that this knowledge contributes to building an innovative economy that benefits all Canadians.

Knowledge Matters: Skills and Learning for Canadians recognizes that a country's greatest resource in the knowledge society is its people. It looks at what we can do to strengthen learning in Canada, to develop people's talent and to provide opportunity for all to contribute to and benefit from the new economy.

Both publications are also available electronically on the World Wide Web at the following address: **http://www.innovationstrategy.gc.ca**

This publication can be made available in alternative formats upon request.
Contact the Information Distribution Centre at the numbers listed below.

For a print copy of this publication, please contact:

Information Distribution Centre
Communications and Marketing Branch
Industry Canada
Room 268D, West Tower
235 Queen Street
Ottawa ON K1A 0H5

Tel.: (613) 947-7466
Fax: (613) 954-6436
E-mail: **publications@ic.gc.ca**

Permission to Reproduce. Except as otherwise specifically noted, the information in this publication may be reproduced, in part or in whole and by any means, without charge or further permission from Industry Canada, provided that due diligence is exercised in ensuring the accuracy of the information reproduced; that Industry Canada is identified as the source institution; and that the reproduction is not represented as an official version of the information reproduced, nor as having been made in affiliation with, or with the endorsement of, Industry Canada.

For permission to reproduce the information in this publication for commercial redistribution, please e-mail: **Copyright.Droitsdauteur@pwgsc.gc.ca**

Note: Industry Canada does not hold the copyright on many of the photographs used in this publication. Permission to reproduce must be sought from the copyright holder.

Cat. No. C2-596/2001E-IN2
ISBN 0-662-31225-2
53564B

Aussi disponible en français sous le titre : Atteindre l'excellence — Investir dans les gens, le savoir et la possibilité.

BEST COPY AVAILABLE

CONTENTS

Message from the Prime Minister		**2**
Message from the Minister of Industry		**3**
1	**Introduction**	**4**
2	**How Is Canada Doing in a World Driven by Innovation?**	**12**
	Canada Is Progressing Toward a More Innovative Economy	12
	Factors Affecting Innovation Outcomes	19
	A Growing Consensus	22
3	**Government Support for Innovation: 1995 to 2001**	**24**
4	**An Innovation Strategy for the 21st Century**	**32**
5	**The Knowledge Performance Challenge**	**34**
	Private Sector Innovation	36
	Factors That Affect the Commercial Application of Knowledge	40
	Goals, Targets and Priorities	51
6	**The Skills Challenge**	**54**
	New Graduates	56
	Immigration	57
	The Adult Labour Force	58
	Goals, Targets and Priorities	60
7	**The Innovation Environment Challenge**	**62**
	Stewardship: Protecting the Public Interest	64
	Taxes	67
	Branding Canada	68
	Goals, Targets and Priorities	70
8	**Sources of Competitive Advantage Are Localized**	**72**
	Large Urban Centres	72
	More Innovative Communities	74
	Goals, Targets and Priorities	76
9	**A Call for Action**	**78**
	The Business Community	79
	Provincial and Territorial Governments	80
	Universities and Colleges	80
10	**Building a More Innovative Canada: Next Steps**	**82**
Appendix A: Achieving Excellence: Investing in People, Knowledge and Opportunity		**84**
Appendix B: Innovation Strategies in Other Countries		**89**
List of Charts and Tables		**91**

Canada is one of the world's great success stories.

Thanks to the hard work, ingenuity and creativity of our people, we enjoy extraordinary prosperity and a quality of life that is second to none. Ours is a history of adaptation and innovation. We have grown from a small agrarian nation at the time of Confederation to a global industrial powerhouse. And we have done this in the Canadian way: by building a partnership among citizens, entrepreneurs and governments that encourages new ideas and new approaches and which energetically seizes new opportunities.

The Canadian way also entails an abiding national commitment to sharing prosperity and opportunity; to the belief that economic success and social success go hand in hand; and that all Canadians should be afforded the means and the chance to fulfill their individual potential and to contribute to building a higher Canadian standard of living and a better quality of life.

In the new, global knowledge economy of the 21st century prosperity depends on innovation which, in turn, depends on the investments that we make in the creativity and talents of our people. We must invest not only in technology and innovation but also, in the Canadian way, to create an environment of inclusion, in which all Canadians can take advantage of their talents, their skills and their ideas; in which imagination, skills and innovative capacity combine for maximum effect.

This has been an overriding objective of our government and was the basis of our 2001 Speech from the Throne. And it is why we are so committed to working with the provinces, the territories and our other partners on a national project to build a skilled workforce and an innovative economy.

To stimulate reflection and to help crystallize a Canada-wide effort, we are releasing two papers: *Knowledge Matters: Skills and Learning for Canadians* and *Achieving Excellence: Investing in People, Knowledge and Opportunity.* From this starting point, we look forward to building a broad consensus not only on common national goals, but also on what we need to do to achieve them in the Canadian way.

Jean Chrétien
Prime Minister of Canada

BEST COPY AVAILABLE

Ingenuity has always been crucial to human progress. It brought us the printing press, the steam engine, electricity and the Internet. Each of these inventions forever altered the way we live our lives and the way we relate to each other. Today, dramatic advances in medical research, telecommunications and science are changing the world in which Canada must compete.

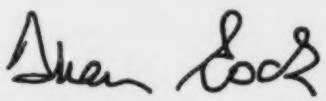
Canadian ingenuity has contributed to the world's innovations — the telephone, insulin, the pacemaker, the Canadarm. We have the most highly educated work force on Earth. In recent years, Canada has eliminated public deficits, kept inflation low, dramatically reduced unemployment, improved our debt-to-GDP ratio, and made significant investments in the infrastructure that supports research and development. This has helped to make Canada a competitive and desirable place to do business. But it is not enough.

Now, we must take it to the next level. We need to find ways to support the Canadian research teams that make groundbreaking discoveries; our companies that have captured new markets with innovative products and services; our traditional industries that continue to innovate, proving they can compete globally; and the Canadian communities that have attracted world-class expertise and entrepreneurial talent.

It is time to take what Canada has done well and ask ourselves: *How do we do more of this, faster? How can we multiply our successes across the country and into the future?* It is time to galvanize a truly national effort to achieve excellence in all we do: to be the best and nothing less.

If we succeed, the reward will be an improved quality of life for *all* Canadians. We will need a partnership among all levels of government, researchers, academia, businesses and all Canadians. *Achieving Excellence: Investing in People, Knowledge and Opportunity* gives us the blueprint to develop that partnership. Now, we must debate these ideas as a nation. We must understand that our success will allow Canada to define itself in the world.

We have all the imagination, creativity and ingenuity we need. Our challenge is to put these to work for Canada and for all Canadians.



Allan Rock
Minister of Industry

INTRODUCTION

INNOVATION IS THE PROCESS THROUGH WHICH NEW ECONOMIC AND SOCIAL BENEFITS ARE EXTRACTED FROM KNOWLEDGE

Through innovation, knowledge is applied to the development of new products and services or to new ways of designing, producing or marketing an existing product or service for public and private markets. The term "innovation" refers to both the creative process of applying knowledge and the outcome of that process. Innovations can be "world first," new to Canada or simply new to the organization that applies them. Innovation has always been a driving force in economic growth and social development. But in today's knowledge-based economy, the importance of innovation has increased dramatically.

KNOWLEDGE HAS BECOME THE KEY DRIVER OF ECONOMIC PERFORMANCE

The factors governing a firm's economic success in the past, such as economies of scale, low production costs, availability of resources and low transportation costs, still contribute to a firm's economic success today. The difference is that today a much heavier emphasis is being placed on knowledge and the resource that produces it: people. Knowledge is the main source of competitive advantage, and it is people who embody, create, develop and apply it. One need only look at employment creation in Canada to see how important knowledge has become (Chart 1).

Innovation is also now seen as something that can be promoted *systematically* across the economy, and not only in research and development (R&D) laboratories. We used to think of innovation as something that just happened based

The Canadian Handshake

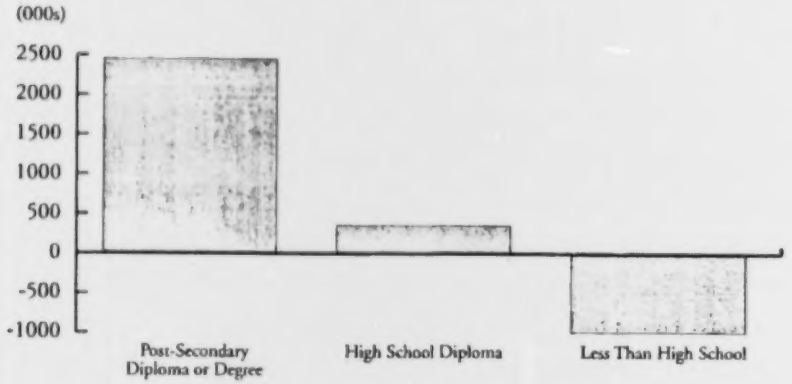
Canadian astronaut Chris Hadfield sparked national pride when he installed Canadarm2 on the International Space Station. The mission highlight was when two generations of Canadian robotic arms worked together in space, reaffirming Canada's reputation as a leader in robotics technology.

© Photos courtesy of Technology Partnerships Canada

BEST COPY AVAILABLE

NASA Image courtesy Canadian Space Agency, www.space.gc.ca

Chart 1: Net Change in Employment in Canada, 1990–2000



Source: Compilation based on Statistics Canada's Labour Force Surveys, 1990–2000.

BEST COPY AVAILABLE

on individual entrepreneurial spirit. Now we view innovation as something that can be encouraged as part of a deliberate strategy to improve national productivity growth and Canadians' standard of living. The conscious promotion of innovation has become an important focus of economic and social policy.

THE SPEED OF INNOVATION IS ACCELERATING

New knowledge is being built upon the stock of old knowledge more quickly than ever before. New products are rapidly replacing old ones. New production technologies are being applied over shorter time frames. The "product cycle" in many industries is becoming shorter.

Rapid technological advances in the information and communications technologies sector are important innovations in their own right. Of even more significance, they are the drivers behind new waves of transformative research and technological developments in other sectors, including the life sciences, natural resources, the environment, transportation and advanced manufacturing. Just as computers and telecommunications are transforming our lives, so too will the promise of biotechnology and genomics — the science of deciphering and understanding the genetic code of life.

EVERY PART OF CANADA AND CANADIAN SOCIETY HAS A STAKE IN THE KNOWLEDGE-BASED ECONOMY

Barely a decade ago, it was common to equate the knowledge-based economy with specific sectors, such as information and communications technologies, or with regions, such as Silicon Valley in the United States. Now the knowledge-based economy knows few, if any, industrial or geographic boundaries. In all industries, from natural resources to manufacturing to services, new knowledge and new means of adding value are being developed and applied to improve economic performance.

Truck Drivers and Technology

Commercial operators are required to communicate with their companies, dispatchers, shippers, and customs officers using sophisticated on-board computers and other high-tech communications equipment. Drivers are required to operate and interpret on-board systems that dictate speeds and vehicle configurations for optimum fuel efficiency. Overall carrier efficiency and competitiveness increasingly depend on commercial operators having these skill sets.

Precision Farming

A new farming practice called "precision farming" relies on the Global Positioning System. A yield monitor installed inside a tractor uses the system to nail down vital information on different fields. Using this technology, a farmer can figure out which areas need higher pesticide application and moisture. Precision farming is earning a reputation as one of the best ways to increase yields and profit — simply by helping farmers make better choices.

BEST COPY AVAILABLE

New Therapy for the Treatment of Vision Loss

A Canadian company recently received approval for a new therapy to treat the wet form of age-related macular degeneration (AMD), the leading cause of severe vision loss in people over the age of 50. This therapy represents the first real treatment for patients with AMD, offering respite from a condition that seriously diminishes quality of life.

In agriculture, for example, advances in biological sciences and computing technology have combined to accelerate the development of new products from renewable agricultural resources. Crops are now being grown for new uses such as renewable fuels and "nutraceuticals" — sources of medicinal substances. These products are capturing premium prices by meeting high safety and environmental standards, and by meeting increased demand in specialty markets for customized products.

In the cultural sector, innovation, knowledge and creativity are combining to generate new forms of artistic expression. Canadian artists are using leading-edge technologies such as broadband and multimedia. Live performances powered by wireless microphones, new materials and fabrics for costumes and sets, and sophisticated computer-operated stage lighting have transformed the performing arts. A vibrant cultural community is both a product and a part of a modern knowledge-based economy, generating new ideas, stimulating creativity in the wider economy and society, and contributing to a rich and rewarding quality of life.

The application of innovations in health, education, sustainable energy, transportation, security and eco-efficiency is making a direct contribution to improving quality of life in Canada. Innovations such as fuel cells, water filtration membranes and new bioremediation technologies are improving the quality of our air, water and soil. Innovation is contributing to better health outcomes for Canadians with new, more effective drug therapies, surgical techniques, diagnostic procedures and prostheses. New gene-based therapies are on the horizon, promising to unleash a wave of more effective and, in many cases, less invasive treatments for a host of diseases and conditions. Improved security measures at airports, including facial recognition systems, iris scans and automatic thumb printing, will be made possible by new and innovative technologies.

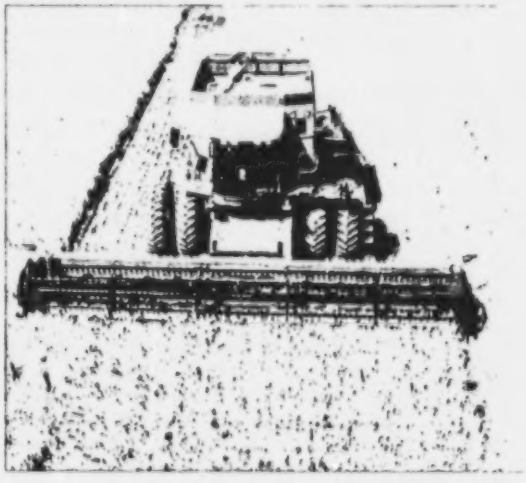


Photo courtesy of Agriculture and Agri-Food Canada

BEST COPY AVAILABLE

First Nations — Seizing Opportunities

The fiscal accountability and business savvy of the First Nations community based in Membertou, Cape Breton, is transforming the community. The band has attracted the attention of business partners across the continent, and has received ISO 9000 certification of its governance process — the seal of approval in international business. Last year, Membertou's 1000 members generated $52 million in economic activity, and the community's social conditions have improved significantly.

Innovation not only crosses all sectors, but also reaches into every urban centre and into the smallest rural, remote and First Nations communities. Today, in every region of Canada, communities are seizing the opportunities of the knowledge-based economy, building on local strengths and developing new areas of expertise.

CANADA WILL SECURE ITS COMPETITIVE ADVANTAGE IN THE GLOBAL, KNOWLEDGE-BASED ECONOMY BY MAXIMIZING ITS CAPACITY TO INNOVATE

For Canadian businesses, innovation means greater competitiveness in markets that are increasingly global. Canada's most innovative industries have better productivity performance, grow faster, and generate higher quality, higher paying jobs. Our most innovative industries are also outward-oriented — competing more successfully in world markets.[1]

For Canadians, innovation means a better standard of living, higher incomes, and more and better jobs. When new technologies and other kinds of innovations are developed here, Canadians enjoy the double benefit of the improvements they bring to quality of life and the economic benefits they yield in terms of job creation. With innovation-driven economic growth come more opportunity and greater choice for citizens — including the wealth needed for new social investments in areas such as education, health and culture.

1. Wulong Gu, Gary Sawchuk and Lori Whewell, *Innovation and Economic Performance in Canadian Industries*, Industry Canada, mimeo, 2001. High-innovation industries include high R&D performers that had a high incidence of patenting and demonstrated greater international competitiveness.

© Photo courtesy of Aboriginal Business Canada

BEST COPY AVAILABLE

Next Generation Wheelchairs

Calgary's Southern Alberta Institute of Technology is helping a small company with the design and prototyping of an innovative wheelchair drive mechanism. The modified drive system will allow the operator to manually propel the chair through horizontal motion rather than the traditional rotational motion. The novel wheelchair will alleviate muscular, joint and other health problems related to the rotational movement of arms.

Seabed Mapping

Using Canadian seabed mapping technologies, a Nova Scotia-based company improved its productivity and reduced the environmental impact of its activities. Seabed mapping technologies generate three-dimensional images of the sea floor through state-of-the-art data collection and remote sensing technologies. These technologies have helped the company pinpoint the optimal locations for scallop harvesting, and avoid harvesting in environmentally sensitive areas.

INNOVATION IS MARKET DRIVEN AND GLOBAL

Firms are at the centre of innovation, particularly in the development and commercialization of new products and technologies. Many Canadian firms — large, medium-sized and small — are developing new products. Many more are applying new technologies in their businesses to improve their productivity performance and to advance the eco-efficiency of materials, manufacturing processes and products. Others are innovating through new means of organizing, financing, marketing and managing. Being innovative involves many things. It can involve research but it is also about focused business strategies, a global approach, competitive financing, risk management and organizational change.

The business acumen and entrepreneurship of individual firms are key drivers of innovation in Canada. But innovation does not come without risk. Often, the payoff for investing in the development of new products, processes or techniques is uncertain. Competition is fierce, and ever-larger investments are required to bring new discoveries to market.

PARTNERSHIPS ARE KEY TO EXPANDING INNOVATION OPPORTUNITIES AND MITIGATING RISK

Universities, colleges, research hospitals and technical institutes play an important role in performing research and advancing the creation of knowledge. They help the private sector develop and adopt innovations. They are also the dominant players in terms of training the highly qualified people that create and apply knowledge.

Agribusiness

The Olds College Centre for Innovation (OCCI) is a newly formed incubator that performs applied research with industrial partners and supports the commercialization of new agricultural products. Fuelled by public and private sector investment, OCCI is strengthening the innovation capacity of the agriculture sector in western Canada.

BEST COPY AVAILABLE

Cell Phones

Unfinished conversations on your cell phone will soon be a distant memory, thanks to a Canadian university researcher. He theorized that a radio circuit could be designed on a more efficient microchip to greatly extend battery life. His design proved not only possible but also as easy to mass-produce as potato chips.

Governments are responsible for research in support of the "innovation environment" — the policies that define many of the incentives to innovate and protect the public interest. Governments also perform research, often with longer time horizons than the private sector, to support their economic development mandates. Governments provide the financial support that enables academic institutions to perform research and train the next generation of highly qualified people. Government laboratories are increasingly forming partnerships with each other, with academic institutions and firms, and with organizations around the world. Partnerships are increasingly key to creating and applying the knowledge that underpins sound regulation and economic development. In performing these functions, governments should themselves be more innovative and contribute to a public environment that is more supportive of creativity and innovation.

COUNTRIES THAT ARE INNOVATIVE WELCOME CHANGE AND EMBRACE IT AS A FUNDAMENTAL VALUE, VIEWING IT AS AN OPPORTUNITY

Innovative countries are constantly on the lookout for new opportunities — new ways to improve their economic prospects and their quality of life. Innovative societies are entrepreneurial. They create wealth, reward individual initiative, strive for international excellence and contribute to a higher quality of life for all their members. Innovative countries are open and inclusive. They value knowledge wherever it originates and offer world-class opportunities, not only to all their citizens, but also to talented individuals from around the world. Innovative countries place a high priority on investments in innovation and strive to maintain their investments during economic downturns.

Wildland Fire Information System

Some 10 000 wildfires burn roughly 2.5 million hectares of forests every year at a cost of roughly half a billion dollars. The Canadian Forest Service of Natural Resources Canada is a world leader in developing wildland fire information systems that help fire managers evaluate the risks and spread of forest fires. Components of this system are now being used in Alaska, New Zealand, Florida, and ASEAN (Association of South-East Asian Nations) countries to address this problem.

BEST COPY AVAILABLE

Canada's goal should be no less than to become one of the world's most innovative countries. To achieve this goal, we require a national innovation strategy for the 21st century. *Achieving Excellence: Investing in People, Knowledge and Opportunity* is an important step to this end. It provides an assessment of Canada's innovation performance, proposes national targets to guide the efforts of all stakeholders over the next decade, and identifies a number of areas where the Government of Canada can act to improve the nation's innovation performance (see Appendix A). This alone is not enough. To succeed, all levels of government, the private sector, academia and other stakeholders must contribute to making Canada more innovative.

Achieving Excellence: Investing in People, Knowledge and Opportunity will form the basis for discussions between the Government of Canada and key stakeholders over the coming months. The objectives are to:

- develop a common understanding of the nature of Canada's innovation challenge;
- reach agreement on national targets that will guide all of our efforts;
- solicit feedback on the proposed priorities for action;
- identify complementary commitments by partners; and
- build support for tracking progress and reporting to Canadians on the results of these efforts.

HOW IS CANADA DOING IN A WORLD DRIVEN BY INNOVATION?

Governments, academia and the private sector have made significant investments in innovation in recent years. As a result, Canada's innovation performance is improving at a quick pace, and we enjoy the fastest rate of growth in some areas. However, a number of other countries moved earlier. Consequently, we lag behind many developed countries in terms of our overall innovation performance. There is no time to waste. International bodies, such as the World Economic Forum, believe that Canada's future economic prospects are significantly more promising than our current performance. This gives us confidence that we are on the right track. But we need to build aggressively on our strengths to realize our potential.

CANADA IS PROGRESSING TOWARD A MORE INNOVATIVE ECONOMY

The global economy began showing signs of weakness early in 2001. The International Monetary Fund reduced its forecast for global growth significantly, reflecting the situation in the U.S., persistent difficulties in Japan, poorer prospects in Europe and a marked decline in several emerging countries. The events of September 11 significantly worsened the state of the U.S. economy.

For the first time in 25 years, Canada is in the midst of a slowdown that is happening concurrently in every major market in the world. More than 40 percent of Canada's economic activity is generated by exports, and these have been hit hard by the global slowdown. This was reflected in our weaker performance in the first half of 2001. The events of September 11 further affected our performance, particularly in sectors such as transportation and tourism.

In this period of uncertainty it is important to restore a sense of personal security, and that was a key goal of the Government of Canada's 2001 budget. But the budget also set out a series of important investments to provide stimulus in a time of economic slowdown and to advance Canada's medium- and long-term economic prospects. The government found

BEST COPY AVAILABLE

the room to sustain its commitment to the innovation agenda through strategic initiatives.

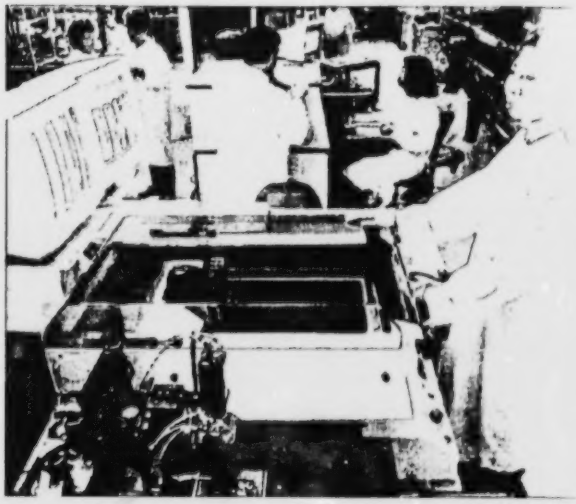
Our economic success will be determined by the degree to which we understand the great currents that are shaping the world of tomorrow. They are to be seen in the transforming impact of new technologies. They are to be secured through strong economic fundamentals. They are to be seized by focusing on the ingenuity and innovation of our people. Since 1993, the Government of Canada has pursued a long-term plan that speaks to these priorities and lays the foundation for strong and durable growth.

By world standards, Canadians enjoy an outstanding standard of living and quality of life. Income levels are high, life expectancy is long, the population is healthy, our communities are safe and our natural environment is second to none. Canada consistently ranks at or near the top in terms of the best country in the world in which to live. But we also have significant challenges that we must collectively face and overcome. *Achieving Excellence: Investing in People, Knowledge and Opportunity* focuses necessarily on those challenges. It encourages Canadians to confront them confidently, with faith in our abilities and knowing that we are building on a base of strength.

Standard of Living

Canada's standard of living is high by world standards. We are the seventh highest ranking country in the Organisation for Economic Co-operation and Development (OECD) in terms of real income per capita. Only two countries surpass Canada by a significant margin: Luxembourg and the U.S. (Chart 2).[2]

2. OECD, *OECD in Figures: Statistics in OECD Member Countries*, 2001.



© Photo courtesy of Technology Partnerships Canada

Chart 2: GDP per Capita

(US$, using purchasing-power parities, 2000)

Source: OECD, *OECD in Figures*, 2001.

However, real incomes in Canada have been steadily falling relative to the U.S. over much of the last two decades (Chart 3). The income gap narrowed somewhat in 1999, and again in 2000, suggesting that we are making progress in this important area. The outstanding gap with the U.S. is, however, cause for concern because the U.S. is our closest neighbour, largest trading partner and key competitor.

We must continue to narrow the standard of living gap with the U.S. by innovating and providing more opportunities for Canadians. If we do not, we risk an outflow of talent and capital that could contribute to a decline in our standard of living.

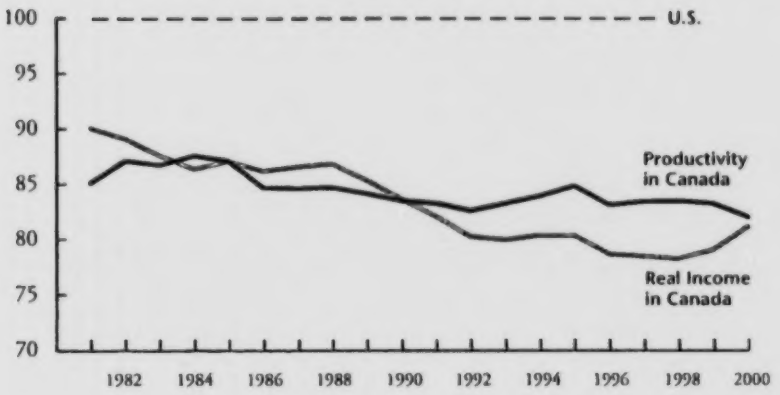
Productivity

There are only two ways to raise a country's standard of living: increase the number of people working and/or raise the level of productivity. Canada cannot rely on the former, given demographic pressures. An ageing labour force and a smaller youth cohort mean relatively fewer workers will be supporting the Canadian population in the future. We must, therefore, become more productive, and we must improve at a faster rate than the U.S.

Most of Canada's standard of living shortfall with respect to the U.S. is due to our markedly lower level of productivity. Canada's overall productivity level — measured in terms of GDP per hour worked — is about 19 percent lower than that of the U.S. (Chart 3).

Chart 3: Standard of Living and Productivity*

Canada relative to the U.S. (U.S.=100)



*Productivity is measured as real GDP per hour worked. Real income is measured as real GDP per capita. Canadian values were converted to 2000 US$ using 2000 purchasing-power parity.

Source: Compilations based on data from Statistics Canada and U.S. Bureau of Economic Analysis.

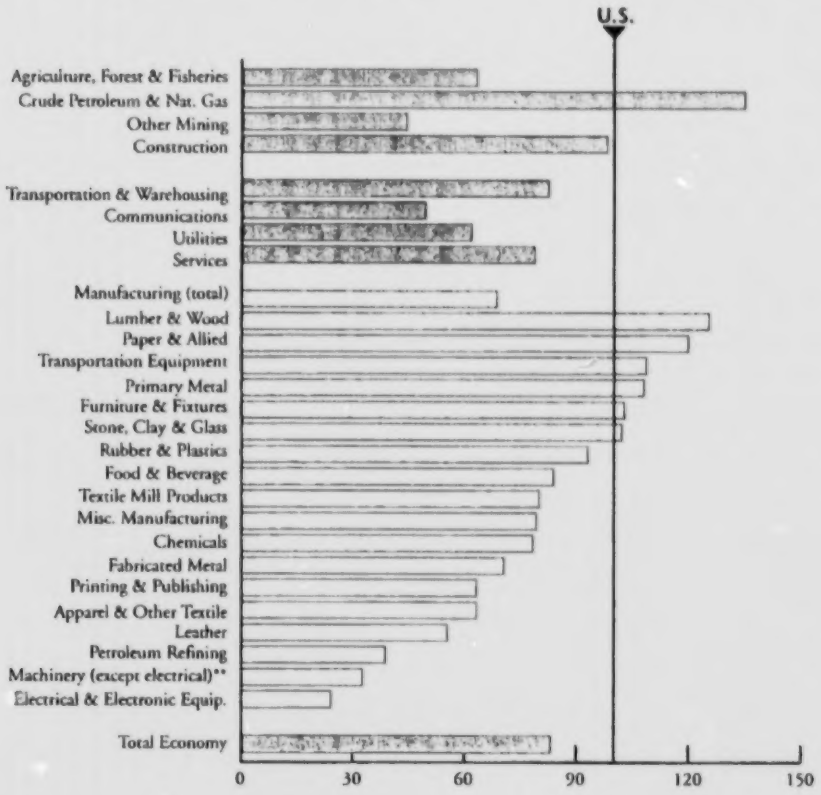
Productivity has grown significantly in Canada over the last number of years; but the gap with the U.S. has continued to widen because we are not improving as fast.

Canadian productivity levels exceed those in the U.S. in some industries (Chart 4). We are performing relatively well in the crude petroleum and natural gas sector, and in the manufacture of primary metal, paper and allied products, lumber and wood, and transportation equipment.

Much of Canada's overall productivity gap with the U.S. is due to differences in the size and productivity growth of the information and communications technologies sector. The U.S. has been able to more rapidly shift its industrial composition toward highly productive industries such as electrical and electronic equipment, and communications. Within Canada, these are the industries that are leading growth in productivity, albeit not as fast as in the U.S.

Chart 4: Labour Productivity,* 1999

Canada relative to the U.S. (U.S.=100)



*GDP per worker.
**Machinery industry includes Computer and Office Equipment.

Source: Industry Canada computations based on data from Statistics Canada, U.S. Bureau of Economic Analysis and OECD STAN database.

BEST COPY AVAILABLE

Innovation

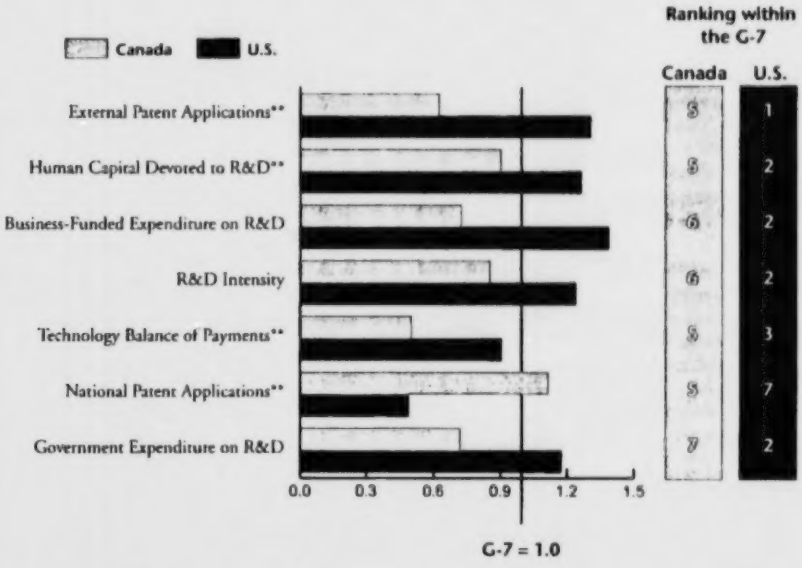
Innovation is the key to improving productivity. Canada's overall level of innovation capacity is near the bottom in the G-7 (Chart 5). We continue to exhibit what the OECD referred to in 1995 as an "innovation gap."

The Conference Board of Canada recently reinforced this point. Its report, *Performance and Potential 2001–02,* rates Canada as a relatively poor performer in innovation (Table A). We do not compare well to benchmark countries across a range of indicators, including R&D spending as a percent of GDP, number of external patent applications and number of researchers relative to the size of our labour force.

© Photo courtesy of Technology Partnerships Canada

Chart 5: Canada's Innovation Performance

Standing relative to the G-7, 1999*



*Or latest available year.
**Adjusted by size of labour force.

Source: OECD, *Main Science and Technology Indicators,* 2001:2.

BEST COPY AVAILABLE

Table A: Canada's Performance, 2001–02

Category	Canada's Performance	Top Performer
Economy	Average	U.S.
Labour markets	Top	U.S.
Innovation	Poor	Sweden
Environment	Poor	Sweden
Education and skills	Average	U.S.
Health and society	Average	Japan

Source: The Conference Board of Canada, *Performance and Potential 2001–02*, 2001.

Building high-performing innovative organizations in both the public and private sectors requires the commitment of top management and all employees. According to The Conference Board, Canada's corporate leaders need to become more passionate about innovation and commit their organizations to it.

The World Economic Forum similarly ranks Canada's current performance as weak, with a "current competitiveness" ranking of 11th in the world (Table B).

Table B: Canada's Innovation Environment
Canada/U.S. Rankings, 2001

	Canada	U.S.
Current Competitiveness	11	2
Growth Competitiveness	3	2

Source: World Economic Forum, *Global Competitiveness Report*, 2001.

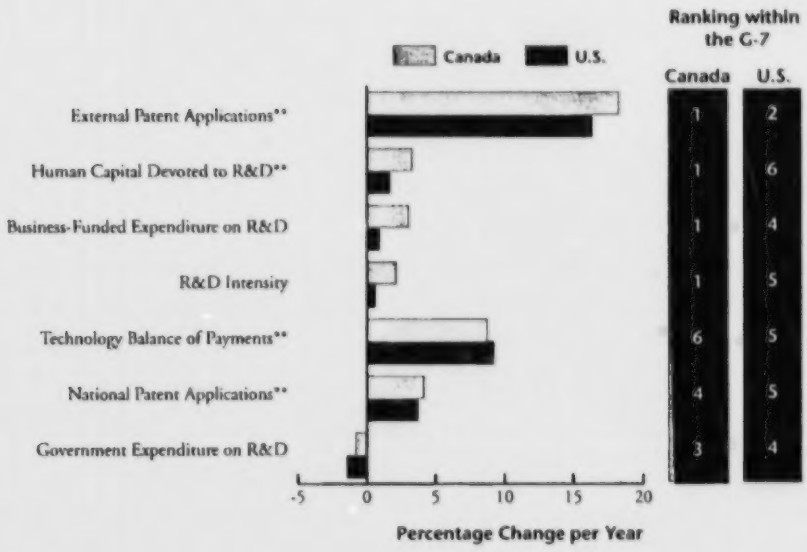
Canada has significantly improved its innovation performance over the last few years across a range of key indicators (Chart 6). We have achieved the fastest rate of growth in the number of workers devoted to R&D, in external patent applications, and in business expenditures on R&D among the G-7 countries. Patent activity has been particularly strong for our information and communications technology and biotechnology sectors. R&D expenditures (as a percent of GDP) have also increased at the fastest pace in the G-7.

These gains demonstrate Canada's commitment to innovation. But they are not enough. On most innovation measures Canada started from well back and our gains, while impressive, have not been sufficient to position us strongly in a North American and international context.

Canada's future prospects are brighter according to the World Economic Forum, which gives us a "growth competitiveness" ranking of third. The optimistic assessment of Canada's future economic prospects suggests that we have been making the right policy choices and that businesses are moving in the right direction.

Chart 6: Canada's Innovation Performance

Average annual rate of growth, 1981–99*



*Or latest available year.
**Adjusted by size of labour force.

Source: OECD, *Main Science and Technology Indicators*, 2001:2.

BEST COPY AVAILABLE

FACTORS AFFECTING INNOVATION OUTCOMES

This document is organized around three key factors that profoundly influence innovation outcomes: knowledge performance, skills, and the innovation environment. These elements of the national innovation system come together at the community level. Subsequent sections develop a more detailed diagnostic and prescriptions for action.

Knowledge Performance

Many Canadian firms are developing new and improved products for world markets and are actively investing in new and advanced technologies. However, to match world leaders, we must invest in more R&D.

Canada's gross expenditures on R&D reached $21 billion in 2001, up 9 percent over 2000, which, in turn, had increased by 11 percent over 1999.[3] Despite these significant investments, Canada ranks only 14th in the OECD in gross expenditures on R&D relative to GDP.[4] Our weak performance results from low levels of R&D spending in all three key sectors: businesses, universities and governments. Increased investments in R&D are required to generate the knowledge that fuels innovation.

Canadian firms also need to form more of the technology alliances that are key to innovation. In addition, Canada's venture capital industry needs to provide more specialized services to firms with rapid growth potential and tap into new sources of capital.

These challenges must be addressed because the creation and commercial application of knowledge is critical to the competitiveness of the private sector. Governments also require access to a strong knowledge base to protect the public interest in terms of health and safety, for example, and to promote innovation through good policies and smart regulation.

The Knowledge Performance Challenge: Canadian firms do not reap enough benefits from the commercialization of knowledge, and Canada underinvests in research and development. (Section 5 addresses these issues in greater detail.)

Skills

Canada's educated population and highly skilled work force are key strengths in the global economy. However, our supply of highly qualified people is far from assured in the medium term. Canada will have great difficulty becoming more competitive without a greater number of highly qualified people to drive the innovation process and apply innovations, including new technologies.

Skill requirements in the labour market will continue to increase at a rapid pace. Firms will be looking for more research personnel — technicians, specialists, managers — to strengthen their innovative capacity and maintain their competitive advantage. Universities, colleges and government laboratories have already begun launching a hiring drive to replace the large number of professors, teachers, researchers and administrators reaching retirement age. This will result in a huge demand in Canada for highly qualified people.

3. Statistics Canada, *Science Statistics*, Cat. No. 88-001-XIB, Vol. 25, No. 8, November 2001.

4. OECD, *Main Science and Technology Indicators*, 2001:2.

On the supply side, Canada has experienced sluggish growth in higher education participation rates in recent years. In addition, we do not compare well to other countries in terms of upgrading the skills of the existing work force through employee training. While our track record in attracting skilled immigrants is good, we will need to more aggressively seek out highly qualified immigrants in the next decade. If we do not address these issues, Canada will face persistent shortages of the skills required for success in the knowledge-based economy.

Shortages will be exacerbated by international competition for talent as the most advanced economies experience many of the same economic and demographic pressures. If Canada does not take measures *now*, we will certainly face critical shortages in the talent we need to drive our economy.

The Skills Challenge: Canada must ensure that in years to come it has a sufficient supply of highly qualified people with appropriate skills for the knowledge-based economy. (Section 6 addresses these issues in greater detail.)

Innovation Environment

Governments must protect the public interest while encouraging and rewarding innovation. A world-class innovation environment suffers no trade-offs between the two.

Governments carry out their "stewardship" responsibility using instruments such as legislation, regulations, codes and standards. Canada has a strong record in using these tools to ensure that citizens enjoy the benefits of innovation without fearing adverse health, environmental, safety or other consequences.

The accelerated pace of scientific and technological discoveries is, however, putting pressure on governments' ability to respond. If government policies are not equipped to address new scientific and technological developments, the public may not have confidence in new goods and services. Businesses, in turn, may not have sufficient confidence in the stability and predictability of the environment to invest in the risky business of innovation.

Good stewardship relies on a strong knowledge base, access to specialized expertise, and a willingness to think and partner globally. Governments need to make pro-innovation policy choices and pro-innovation investments to create a climate that is predictable and efficient, accountable to the public, and deserving of the confidence of investors.

Tax policy is among the important levers available to governments to encourage investment in innovation. Canada will soon have one of the most competitive business tax regimes in the world, and reductions to personal income taxes will help to attract more highly qualified people.

It is not enough to put in place the conditions for innovation success. It is essential that investors and highly qualified people recognize Canada as a good location in which to invest and live. Too often, they do not consider Canada. Their perceptions are important and must be addressed, or we risk being bypassed in the intense international competition for investment and talent. Governments in Canada must rise to the challenge of being facilitators of innovation and promoters of the "Canadian brand."

The Innovation Environment Challenge: A "public confidence gap" may emerge if stewardship regimes do not keep pace with innovation and technological change. A "business confidence gap" may emerge if businesses are not assured that the policy environment is supportive of innovation and investment, and is recognized as such. (Section 7 addresses these issues in greater detail.)

It is in communities where these elements of the national innovation system come together. Innovation thrives in industrial clusters — internationally competitive growth centres. Governments need to recognize the earliest signs of emerging clusters and provide the right kind of support at the right time to create the conditions for self-sustaining growth. Innovation should not, however, be viewed as exclusively based in large urban centres. Many smaller communities have significant knowledge and entrepreneurial resources. They may, however, lack the networks, infrastructure, investment capital or shared vision to live up to their innovative potential. By coordinating efforts, federal, provincial/territorial and municipal governments can work with the private, academic and voluntary sectors to build local capacity and unleash the full potential of communities across the country. (Section 8 addresses these issues in greater detail.)

Reproduced with Permission from Health Canada, 2002
© Minister of Public Works and Government Services Canada, 2002

A GROWING CONSENSUS

There is a strong convergence of views among decision-makers and observers on Canada's innovation challenge. Governments, businesses and their associations, academic commentators and research institutes share the view that innovation is essential to improving Canada's overall economic performance.

In September 2001, federal, provincial and territorial science and technology ministers forged a consensus on the need for Canada to become one of the most innovative nations in the world. Ministers recognize that reaching this objective is a tremendous challenge and will require complementary efforts and approaches on the part of all governments. They adopted principles to guide future action to advance innovation within their respective jurisdictions, and agreed to meet again this year to review progress.

Principles for Action

Federal, provincial and territorial governments support the goal of making Canada one of the most innovative countries in the world. Ministers recognize that this will require a sustained effort on the part of all players, and that different parts of the country require different policies to achieve this goal. The following principles will help governments put in place a framework to take Canada from 14th to 5th in research intensity among industrialized countries. Governments will make best efforts to:

- *create a competitive business climate conducive to industrial innovation;*
- *make Canada's university-based research and innovation system among the best in the world; and*
- *monitor the innovation system as a whole, report on the health of the system, adjust government policies to correct any deficiencies and encourage all parts of the innovation system to work together.*

The Conference Board of Canada has published three annual reports on Canada's innovation performance. These reports conclude that Canada's innovation performance is weak, and that this is affecting productivity levels and economic performance. The Conference Board is promoting the need for simultaneous action at the national level and at the level of the individual firm. Many support their "Call to Action": Canada must strengthen its commitment to innovation, and firms must improve their practices and capabilities to foster innovation. Business associations, such as Canadian Manufacturers and Exporters, have identified the need to use best business practices in change management, and make innovation a priority in all aspects of business operations.

Universities and research hospitals are increasingly seeking out private sector partners to commercialize their research-based discoveries. Meanwhile, technical institutes and colleges are increasingly supporting the product and market development needs of the private sector. Academic institutions have an essential role to play in strengthening Canada's innovation performance. They have acknowledged that they too must continue to strive for excellence and rise to the innovation challenge.

This convergence of views presents an exceptional opportunity for the main partners in innovation to work together to improve Canada's performance. There is also a growing international consensus on the importance of innovation to nations' economic and social well-being (see Appendix B). This provides all the more impetus and urgency for Canada to succeed in positioning itself as one of the most innovative economies in the world.

BEST COPY AVAILABLE

AN EMERGING CONSENSUS ON THE IMPORTANCE OF INNOVATION

Federal-provincial-territorial governments agree on the goal of making Canada one of the most innovative countries in the world … Ministers recognize that this overarching goal cannot be met by government actions alone and call upon all players in the innovation system to play their part.

— *Principles for Action*, Federal-Provincial-Territorial Science and Technology Ministerial Meeting, Québec, September 20–21, 2001

It is time for Canada to adopt a true culture of opportunity and innovation, one that will enable all of us as Canadians to get on with building better lives for ourselves, for our families and for our communities.

— Business Council on National Issues, *Risk and Reward, Creating a Canadian Culture of Innovation*, April 5, 2000

The realities of the market today — intense international competition, the rapid pace of technological development, and the ease with which investment and knowledge flow around the world — mean it is more important than ever for companies to strengthen competitive capabilities based on productivity and innovation.

— Canadian Manufacturers and Exporters, *Canada's Excellence Gap: Benchmarking the Performance of Canadian Industry Against the G7*, August 1, 2001

Canadians must become more innovative. Improvements in our innovative capacity are critical to productivity growth and wealth creation. Companies that are innovative are more profitable, create more jobs and fare better in global markets.

— The Conference Board of Canada, *Performance and Potential 2001–02*, 2001

The private sector, including my own industry and company, needs to be part of the solution as well. We need to foster more innovation to fuel the growth we need to meet our standard of living objective.

— A. Charles Baillie, Chairman and CEO, TD Bank Financial Group, Speech to the Canadian Club, Toronto, February 26, 2001

BEST COPY AVAILABLE

In innovative economies, concerted action on the part of all levels of government and the private sector is the norm. In Canada, federal, provincial and territorial governments have all made innovation a priority.

Each region in Canada has made significant progress in its innovation performance since the early 1990s.[5] All provinces have reduced internal barriers to trade and have increased their trade orientation with the rest of the world. Ontario was out ahead, with trade in goods and services (imports plus exports) representing 90 percent of its economy. Atlantic Canada experienced the largest increase in enrolment in post-secondary science and engineering programs. The Prairies posted the strongest growth in investment in new technologies — machinery, equipment and advanced technologies. Quebec led the way in terms of attracting increased private sector investment in R&D relative to the size of its economy. British Columbia had the highest adult rates of participation in education and training, and the largest share of household computer use. All regions are increasing their share of highly qualified labour as a percent of the labour force. All governments have significantly improved their fiscal situations — many have eliminated their deficits and are now running surpluses. Canada's successful transition to a knowledge-based economy ultimately depends on the progress of our regions.

The Government of Canada has also made innovation a priority. Early in its first mandate, the government recognized that improving Canada's innovation performance requires action on several fronts.

5. Industry Canada, *Canada's Regions and the Knowledge-Based Economy*, 2000.

GOVERNMENT SUPPORT FOR INNOVATION: 1995 TO 2001

© Photo courtesy of Technology Partnerships Canada.

BEST COPY AVAILABLE

Northern Research

The Yukon's Mining Environment Research Group comprises government agencies, mining companies, Yukon First Nations and non-government organizations. It promotes research in mining and environmental issues. The Nunavut Research Institute is part of Nunavut Arctic College. It develops and promotes traditional knowledge, science, research and technology. The Aurora Research Institute, headquartered in Inuvik, works to improve the quality of life in the Northwest Territories by applying scientific, technological and indigenous knowledge to solve northern problems and advance social and economic goals.

Knowledge Infrastructure

The Nova Scotia Research Trust Fund, the British Columbia Knowledge Development Fund, the Manitoba Innovations Fund and Saskatchewan's Innovation and Science Fund invest in infrastructure to ensure that their researchers have access to facilities and equipment that will enable them to perform leading-edge science.

INNOVATION ENVIRONMENT

The Government of Canada initially focused on improving the environment to support innovation by eliminating the disincentive effects of some policies. The government eliminated most subsidies and other direct interventions in the marketplace because competition, not protection, generates innovation. The government continued to liberalize domestic and international trade to open up markets for Canadians across the country and around the world. The Prime Minister and premiers have led Team Canada trips to promote trade in Canadian goods and services and, more recently, to attract investment into Canada. Regional development and sectoral programs were reoriented to support the private sector's transition to the knowledge-based economy.

Putting public finances in order was also a key priority. The Government of Canada eliminated the deficit and is now paying down the public debt. The federal debt represented 52 percent of GDP in 2000–01, and is expected to fall to 47 percent by 2003–04. This progress is impressive given our starting point — the public debt was at 71 percent of GDP in 1995–96.

Lower public debts free up resources to spend on the social priorities of Canadians, such as health care and education. These investments are important in their own right. They also help Canada to attract the highly qualified people that drive innovation because people want to live in safe, clean communities with high-quality services. In addition, a healthy and educated population attracts investment. The Government of Canada is committed to creating a "virtuous circle" where good economic policy creates the wealth to address social priorities, which, in turn, fuels more innovation and economic growth.

Interest rates are very low as a result of the low and stable inflation rate. Taxes are going down, providing relief to Canadian households and businesses. Business and personal income taxes, including taxes on capital gains, will be reduced by a remarkable $100 billion

BEST COPY AVAILABLE

over five years. This combination of low interest rates and tax cuts is providing a stimulus to the economy that will lessen the impact of the current slowdown and will hasten the return of strong growth.

The Government of Canada is also committed to ensuring that stewardship policies protect the public interest in our rapidly changing and ever more complex world. Progressive marketplace policies have been put in place, as in the case of the Electronic Commerce Strategy, which promotes economic development in a manner that respects consumer privacy and other concerns (see Section 7). The government also committed resources to improve the regulatory system for biotechnology — a field that holds incredible promise and opportunity for Canadians, provided we anticipate and manage risks.

KNOWLEDGE PERFORMANCE

Getting the economic fundamentals right enabled the government to address other priorities. Since knowledge is the key to creating economic opportunities and improving quality of life, the government launched a number of complementary initiatives to:

- enable universities to attract the best and the brightest researchers from around the world;
- develop the infrastructure needed to connect researchers, entrepreneurs and investors — since it is at this intersection that ideas turn into action; and
- ensure that our best ideas get developed into new goods and services for the marketplace.

"One of the most consistent threads that runs through our policies in recent years has been a recognition that innovation is key to both the strength of our economy and to the quality of our lives. Budget 2000 and the October Statement built on that imperative, making large, long-term investments in the knowledge infrastructure of our country — our universities and research institutes."

The Honourable Paul Martin, *Economic Update*, Department of Finance, May 17, 2001

The government's expenditures on science and technology are estimated at $7.4 billion in 2001–02, an increase of 25 percent from the previous peak. A key component is the government's growing investment in the three granting councils to support research at Canadian universities and hospitals. As part of this overall effort, the Canadian Institutes of Health Research was launched in 2000. The government brought various research disciplines together for the first time to address the priority health concerns of Canadians. The granting councils' combined budgets are at their highest level ever at more than $1.1 billion annually, with the 2001 federal budget announcing an additional $121-million contribution. The budget also announced $25 million to sustain the Canadian Institute for Advanced Research (a non-profit corporation that supports long-term scientific research) for five years.

Of great significance to the academic community was the 2001 federal budget announcement of a one-time investment of $200 million to help universities and research hospitals cover administration, maintenance, commercialization and other indirect costs associated with federally sponsored research.

The government also launched Genome Canada, a not-for-profit organization dedicated to making Canada a world leader in genomics research. Five new genomics research centres are drawing together researchers from universities, research hospitals, government laboratories, and private companies. This field has the potential to improve the health of Canadians in ways we could not imagine just a few years ago. The 2001 budget announced a further contribution of $10 million to the BC Cancer Foundation to support ongoing research at its Genome Sequence Centre.

To complement investments in research, the government created the Canada Foundation for Innovation to enable universities to renew their research infrastructure — laboratory equipment, facilities and networks. By 2005, the Foundation's total capital investment, along with those of its partners, will exceed $5.5 billion.

Complementary Provincial Initiatives

Alberta's Heritage Foundation for Medical Research supports biomedical and health research at Alberta universities, affiliated institutions, and other medical and technology-related institutions. Quebec has three R&D granting councils to support research in the health, natural sciences and social science fields.

Oil Sands

Canada's oil sands are a world-class, uniquely Canadian resource. We continue to improve the technology to find safe and environmentally sustainable ways of recovering the oil, and to create tens of thousands of jobs developing the oil sands. In cooperation with governments, academics and industry, researchers have helped reduce economic and environmental barriers to the development of this important resource. With $51 billion in new capital expenditures, the oil sands will be Canada's largest natural resource development opportunity in the next decade.

A Collaboration That Really Took Off

Productivity is soaring at a Canadian company — a world leader in the design, manufacture and support of aircraft engines, gas turbines and space propulsion systems — thanks to a mechanical engineering professor at the University of British Columbia. The professor helped the company save millions of dollars on the manufacture of components for jet engines. He developed adaptive control software to optimize the machining process. The system enabled the firm to cut waste, reduce shutdowns and improve productivity by 50 percent. The technology is now in demand by manufacturers around the world. The research collaboration between the professor and the company was supported by grants from the Natural Sciences and Engineering Research Council of Canada.

BEST COPY AVAILABLE

© Photo courtesy of Technology Partnerships Canada.

As part of the Connecting Canadians agenda, the government has supported the development of CA*net 3 to ensure that Canadian researchers can share data, work collaboratively and network with other partners, both in Canada and abroad. As announced in the 2001 budget, the government will provide $110 million of funding to build CA*net 4, a new generation of Internet broadband network architecture that will link all research institutions, including many community colleges, via provincial networks. Successful innovation today depends on the ability of researchers to access and share vast amounts of information quickly and reliably. CA*net 4 will accelerate next generation network applications by enabling medical and genetic research, environmental research and complex simulations. Investments in CA*net 4 will also help to brand Canada as an international network technology leader.

The Government of Canada has also been promoting research and the subsequent development of innovations that are of strategic importance to Canada. Technology Partnerships Canada was created to share the risks of developing strategic world-first technologies with the private sector in priority fields: enabling technologies, environment and aerospace.

Sustainable development is an integral element of the innovation agenda. The government created the Sustainable Development Technology Fund and the Climate Change Action Fund to address global warming and other environmental challenges. These funds support research that will lead to the development of new technologies that will help Canada improve the quality of its air, water and soil. The Canadian Foundation for Climate and Atmospheric Sciences was launched to foster scientific research on the climate system, and environmental indicators are being developed to monitor progress on the status of the environment. In addition, the government has supported complementary sector-specific initiatives, including the Program for Energy R&D, which contributes to a sustainable energy future for Canada, and Technology Early Action Measures, which supports technology projects leading to reductions in greenhouse gas emissions.

The government is committed to bringing university researchers together with firms to ensure that our best ideas make it to the marketplace. The Networks of Centres of Excellence program, which supports collaborative research in priority areas, was made permanent. The networks connect researchers in academic institutions, government and the private sector across a wide range of disciplines and across the country. It is often at the intersection of their fields that the most important innovations emerge. This program has attracted worldwide attention.

The government is also committed to ensuring that it has access to the R&D it needs both to make sound stewardship decisions and to stimulate economic development. The 1999 federal budget committed $65 million to modernize and strengthen the federal food safety system, $42 million to improve the management and control of toxic substances in the environment, food and drinking water, $55 million over three years to support biotechnology research in federal departments and agencies, and $60 million over five years to support the GeoConnections initiative, which makes geographic information more accessible.

Complementary Provincial Initiatives

Many provinces facilitate the commercialization of discoveries. Quebec's Centre de recherche industrielle du Québec responds to industry needs and contributes to the transfer of expertise and know-how to the manufacturing sector. Nova Scotia's Life Sciences Industry Partnership facilitates the identification and development of opportunities in the life sciences industry. Ontario has created Biotechnology Commercialization Centres in Ottawa, London and Toronto. The Atlantic Technology Centre in Prince Edward Island will stimulate new partnerships to encourage innovative applied research and development projects.

BEST COPY AVAILABLE

The Industrial Research Assistance Program helps small and medium-sized firms in Canada develop and adopt new technologies by offering both technical and financial assistance. Meanwhile, the Business Development Bank of Canada's role was reoriented to finance the emerging needs of knowledge-based firms. The Bank not only offers financial services, but also runs a mentoring network to help companies develop and upgrade skills that are critical to their ongoing success.

Ensuring that Canada's regions and communities are all able to make the transition to a knowledge-based economy is another key priority. The Government of Canada created the Atlantic Innovation Fund to improve the Atlantic provinces' capacity to create, adopt and commercialize knowledge. The fund will support partnerships and alliances among firms, universities, research institutions and other organizations in Atlantic Canada.

With research institutes, centres and programs spanning all regions of the country, the National Research Council Canada is making a significant contribution to the development of clusters of research and commercialization activity. The 2001 budget provided an additional $110 million over three years to expand the National Research Council Canada's innovation initiative beyond Atlantic Canada.

SKILLS

The Government of Canada broadened its strategy in 1998 to encourage the development of highly qualified people.

The Canada Research Chairs program was launched to help Canadian universities and research hospitals attract and retain top academic talent from around the world. Budget 2000 committed $900 million over five years to create 2000 new research chairs. With this program, the Government of Canada has gone a long way toward unleashing the full research potential of Canadian universities and affiliated hospitals. They now have the resources to attract and retain top talent, and that talent has access to the funding and infrastructure that will enable them to perform at the leading edge.

The Government of Canada launched Canada Millennium Scholarships to enable more Canadians to pursue a post-secondary education, Canada Study Grants to help students with dependants and disabilities, and Canada Education Savings Grants to enable parents to save for their children's education. Tax measures were also implemented to help Canadians finance their education needs.

Smart Community

In Ontario, the Keewaytinook Okimakanak First Nation, in partnership with governments and the private sector, developed an information and technology service supported by a high-speed broadband network. The network is bringing social and economic advantages to seven communities. It provides a new telephone system with standard telecommunication products, such as e-mail, Internet services and video conferencing. More importantly, the network enables distance education, tele-medicine and multimedia production.

BEST COPY AVAILABLE

Reproduced with Permission from Health Canada, 2002
© Minister of Public Works and Government Services Canada, 2002

The Internet and computer skills are as fundamental to an individual's success in the knowledge-based economy as basic literacy and numeracy skills. To capitalize on the many potential economic and social benefits of innovation, it is essential that all Canadians and businesses have access to the Internet and the skills to use it. Therefore, an element of the Connecting Canadians agenda involves improving access by First Nations and rural communities, and by people with disabilities, to the transformative economic and social benefits of the Internet.

Canada is now recognized as a world leader in connectivity as a result of programs such as SchoolNet, the Community Access Program and Smart Communities. Yet the speed of change continues to accelerate and Canada must continue to develop and strengthen its information infrastructure. Looking ahead, as indicated in the 2001 Speech from the Throne, the government will work with Canadian industry, the provinces and territories, communities and the public on private sector solutions to further broadband Internet coverage in Canada, particularly for rural and remote areas.

A GOOD BEGINNING

The Government of Canada is confident that its approach to improving Canada's innovation performance is the right one. A solid foundation has been laid by systematically focusing on all of the elements of innovation. Moreover, investments in one area often serve to strengthen another component of our innovation system. We are getting tremendous synergy from our investments. It will, however, take time for these investments to pay off. The government is confident that they will. But innovation is a race that is run over and over again as other nations continue to invest in their capacity to innovate. The Government of Canada will do its part by continuing to invest in priority areas.

AN INNOVATION STRATEGY FOR THE 21ST CENTURY

To address the challenges we face and become an innovation leader, Canada needs a consolidated, coordinated and aggressive plan. The Government of Canada will work with the provinces and territories, businesses, academia and others to develop a national innovation strategy for the 21st century. As announced in the 2001 Speech from the Throne, the overall objective should be to ensure that Canada is recognized as one of the most innovative countries in the world.

Clear, shared, long-term goals (e.g. for R&D performance, stewardship and skills development) must form an essential part of the strategy. The Government of Canada is also committed to developing an innovation strategy that will achieve measurable outcomes. Monitoring and reporting on innovation outcomes will make it possible to track performance, make course corrections and improve accountability.

To kick off the development of a national innovation strategy, the remainder of this paper elaborates on Canada's innovation challenge and proposes goals, targets and federal priorities in the following three principal areas.

NASA image courtesy Canadian Space Agency, www.space.gc.ca

BEST COPY AVAILABLE

Knowledge Performance Challenge	Create and use knowledge strategically to benefit Canadians: promote the creation, adoption, and commercialization of knowledge.
Skills Challenge	Increase the supply of highly qualified people: ensure the supply of people who create and use knowledge.
Innovation Environment Challenge	Work toward a better innovation environment: build an environment of trust and confidence, where the public interest is protected and marketplace policies provide incentives to innovate.

© Photo courtesy of Technology Partnerships Canada

THE KNOWLEDGE PERFORMANCE CHALLENGE

To become one of the most innovative countries in the world, Canada must manage knowledge as a strategic national asset. We need to be able to turn our best ideas into new opportunities for global markets. In a global economy where Canada contributes an important, albeit small, portion of the total pool of knowledge, we must also be able to make use of knowledge and technology that is developed around the world.

Many Canadian firms are developing and successfully commercializing new or significantly improved products and services in world markets. Many more are adopting innovations, be they new technologies or improved business practices, which embody the latest thinking from markets around the world. Canada needs to celebrate its successes as we move to create a culture that values innovation and supports innovators.

Canadian investments in machinery and equipment as a percent of GDP are now among the highest in the OECD. Governments compete to attract R&D investment, and Canada lays claim to one of the most favourable R&D tax incentives in the OECD. The private sector is increasing its investment in R&D at the fastest rate in the G-7, and the number of people devoted to R&D in Canada has grown at the fastest pace in the G-7 in the last two decades. Canadian firms are hiring an increasing share of these workers, demonstrating a growing commitment to innovation. The communications equipment and service sectors in Canada are particularly strong R&D performers relative to their counterparts in the OECD. Canada's R&D intensity and external patent applications have grown at the fastest pace in the G-7. Canadian firms also rely more on universities as a source of important research-based innovation than do other G-7 countries.

© Photo courtesy of Technology Partnerships Canada.

Canada has made impressive advances in recent years. But these have not been sufficient to catch up across a range of innovation indicators, relative to other countries, because we started from a long way back. The private sector in Canada needs to develop more aggressively its capacity to commercialize and adopt technologies to remain competitive. This will require an increased investment in research and development, more strategic alliances and improved access to risk capital.

"In 1991, Canada chose the familiar and comfortable path of replication, benchmarking and operational improvement. In 2000, the nation must choose the alternative path of innovation and bold strategy . . . . Canadian firms must understand that competing in Canada alone will eventually destroy them. They must decide to compete globally and compete on the basis of unique products and processes. This road will be profoundly worrisome, even frightening at times, but it is necessary for Canada to prosper and not continue to slowly decline relative to other leading nations."

Roger L. Martin and Michael E. Porter, *Canadian Competitiveness: Nine Years after the Crossroads*, Toronto, Rotman School of Business, January 2000.

BEST COPY AVAILABLE

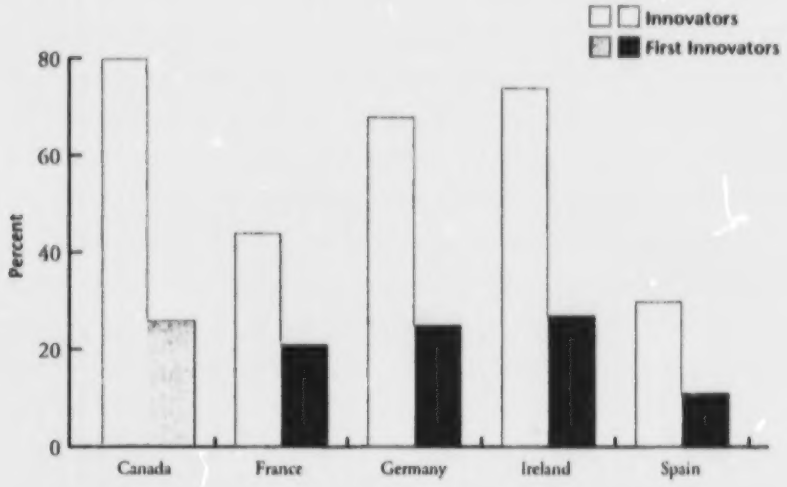
Commercialization

Throughout the 1990s, many Canadian firms responded to globalization by restructuring operations, with an emphasis on cost reduction.[6] This adjustment was eased by the depreciation of the Canadian currency relative to that of our main competitor, the U.S. Cost competitiveness is not sufficient to position companies in a global marketplace where competition is increasingly driven by quality rather than price. To succeed, firms need to apply and commercialize knowledge — to innovate and be first to market with better products and improved processes.

Many firms, large and small, see innovation as *the* way to keep up with competitors, meet changing client needs, grow profit margins and increase productivity. In recent years, at least 80 percent of Canadian manufacturing companies successfully introduced a new or significantly improved product or process (Chart 7). Fully 26 percent of Canadian manufacturing firms were "first innovators." They introduced innovations that were entirely new to Canada or, in some instances, new to the world. First innovators share common characteristics. They are more likely to be large, in the high-technology sector, perform R&D and protect their intellectual property.

6. C. Kwan, "Restructuring in the Canadian Economy: A Survey of Firms," *Bank of Canada Review*, Summer 2000, pp. 15–26.

Chart 7: Innovation Among Manufacturing Firms

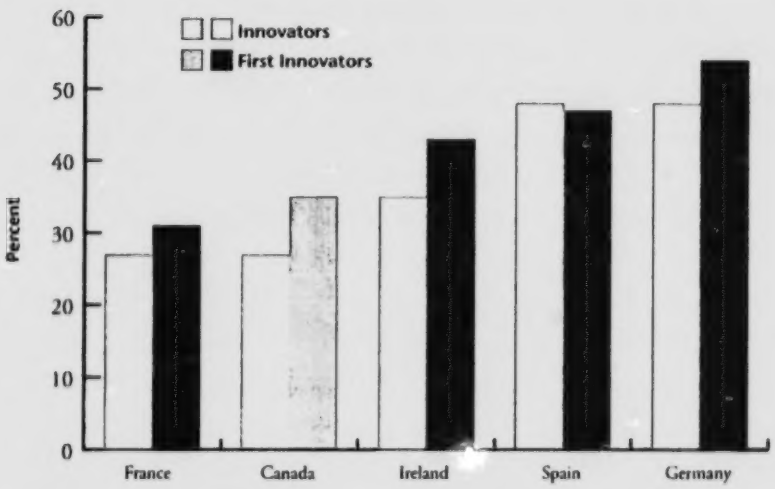


Source: Mohnen and Therrien, *How Innovative are Canadian Firms Compared to Some European Firms? A Comparative Look at Innovation Surveys*, Merit Research Memorandum, 2001-033, Maastricht, 2001.

On the surface, Canada's manufacturing firms appear to be more innovative than their counterparts in select European countries for which there are comparable data. But the real test of an innovation for the firm is whether it has value in the marketplace. Firms in Germany, Spain and Ireland enjoy substantially more sales from their innovations (Chart 8). Canadian firms trail in their ability to capture economic benefits from their innovations. This was confirmed by The Conference Board of Canada. The Board's first annual innovation report served as a challenge to the private sector in noting that:

"While most large Canadian firms innovate in one way or another, there is significant room for improvement. Only two thirds of them innovate in all areas, and only about half of them use all key inputs for technological innovation. Furthermore the level of product innovation in large Canadian companies seems to be weak, given the reduction in product life cycles and the increasing number of new products and services being introduced into the marketplace by competitors. While the report does not investigate smaller firms, there is some evidence that the problem is worse than among larger companies."

Chart 8: Share of Sales from New or Improved Products



Source: Mohnen and Therrien, *How Innovative are Canadian Firms Compared to Some European Firms? A Comparative Look at Innovation Surveys*, Merit Research Memorandum, 2001-033, Maastricht, 2001.

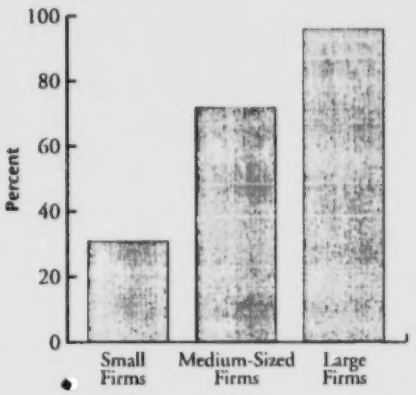
Adopting Innovations

Canadian firms are investing heavily in machinery and equipment. Over the past decade, Canadian investments in this area, as a percent of GDP, went from among the lowest to the highest levels in the OECD.[7] This is important because the adoption of new technologies enables Canadian firms to become more productive and competitive. In addition, new machinery and equipment is often a necessary element of a broader strategy to develop or significantly improve new products for global markets.

Innovative firms do not just adopt new technologies, they adopt advanced, leading-edge technologies. Almost all of Canada's large manufacturing firms are using more than five advanced technologies (Chart 9). Even more encouraging,

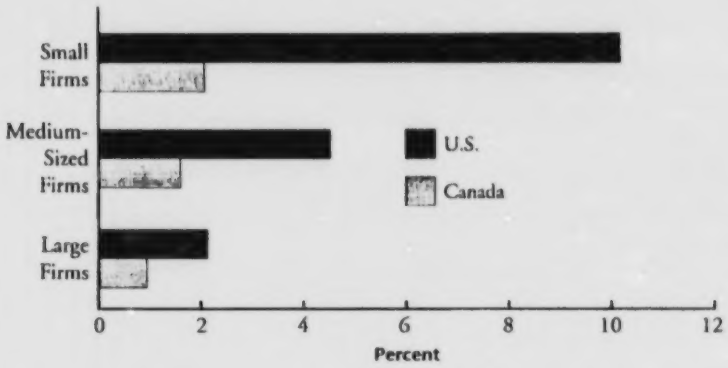
7. The Conference Board of Canada, *Investing in Innovation: 3rd Annual Innovation Report*, 2001.

Chart 9: Canadian Manufacturing Firms Using More Than Five Advanced Technologies



Source: Statistics Canada, special tabulations for Industry Canada based on the *Survey of Advanced Technology in Canadian Manufacturing*, 1998.

Chart 10: E-Commerce Sales as Percentage of Total Sales, 2000



Source: IDC Canada for the Canadian E-Business Opportunities Roundtable, *Canada–US e-Business Gap Analysis*, June 2001.

24 percent of plant managers surveyed believed that they were using more advanced technologies than their U.S. competitors, while another 33 percent rated themselves as equal. On balance, however, the evidence suggests that small, domestic firms are considerably behind foreign-owned firms in the use of advanced technologies.

Canadian firms of all sizes are also considerably behind their U.S. counterparts in adopting the technologies and implementing the innovative business practices required to take advantage of electronic commerce market opportunities. Canadian investments in information and communications technologies (per employee) are well below U.S. levels, and the gap is widening. One effect is to limit Canada's ability to capture electronic market sales (Chart 10).

Information and communications technologies and the Internet are revolutionizing the way companies do business. The transformative impact has been felt in the explosive growth of business-to-business electronic commerce in such areas as procurement, direct sales, inventory management, marketing and product development. Increasingly, customers, partners, suppliers and employees of a firm are connecting among themselves and networking through real time, sharing critical knowledge and information. Decisions and processes that once took days now occur in seconds, driving the entire organization and its partners to higher levels of efficiency, productivity and innovation. There will be serious competitive consequences for firms that fail to take full advantage of these new important technologies.

FACTORS THAT AFFECT THE COMMERCIAL APPLICATION OF KNOWLEDGE

Three factors have a considerable impact on the private sector's capacity to innovate: R&D, strategic alliances and access to risk capital.

Research and Development

Private Sector

The private sector performs about 57 percent of Canada's R&D.[8] Many firms across Canada engage in R&D, and they have access to one of the most generous R&D tax credits in the world. The private sector increased its investments in R&D at a faster pace than did businesses in any of the other G-7 countries. There has also been significant growth in the proportion of total R&D workers in Canada that are employed by industry.

The service sector is among the strong R&D performers in Canada. It accounts for about 27 percent of all business R&D activity, well above the 17 percent OECD average. Canada's communications equipment industry is another bright spot. It invests more in R&D as a percent of sales than its counterparts in other OECD countries.[9]

8. OECD, *Main Science and Technology Indicators*, 2001:2.

9. OECD, *Science, Technology and Industry Scoreboard*, 2001.

Spider Silk

A Canadian company has produced the most realistic, artificial spider silk to date. The fibre is derived from goat's milk genetically modified with spider genes. The resulting material is tough enough to protect spacecraft from flying debris and fine enough to be used in the medical field as sutures.

Ocean Nutrition

A Nova Scotia company is a world leader in the research and production of marine-based natural health and nutritional products (dietary supplements and functional foods). The company employs more than 30 research scientists and operates the largest privately owned marine natural products research facility in North America. It has discovered and developed effective, stable and bioavailable nutrients, which are essential for healthy human cells and reduce the risk of brain disorders. Its high-quality products meet Good Manufacturing Practice standards.

Overall, however, R&D performed by Canada's private sector continues to lag behind major OECD countries. Canada ranks 13th in business spending as a share of GDP, well below internationally competitive levels.[10] To some extent this reflects the larger presence of foreign-controlled firms in Canada (which tend to spend more on R&D in their home countries), a smaller presence of high-technology firms (which tend to be the big R&D spenders), and the predominance of small firms in Canada (which have fewer resources to dedicate to R&D).[11]

10. OECD, *Main Science and Technology Indicators*, 2001:2.

11. Jianmin Tang and Someshwar Rao, *R&D Propensity and Productivity Performance of Foreign-Controlled Firms in Canada*, Industry Canada, Working Paper No. 33, March 2001; and The Conference Board of Canada, *Building the Future: 1st Annual Innovation Report*, 1999.

BEST COPY AVAILABLE

Private R&D expenditures are also highly concentrated in Canada. Four firms account for 30 percent of all private sector research.[12] One sector alone, information and communications technology, accounts for 44 percent.[13]

In the global, knowledge-based economy, firms that invest significantly in R&D are more likely to thrive. They are better able to compete in global markets by offering their customers new or significantly improved products and services. Firms that continue to offer the same goods and services are forced to compete largely on the basis of costs. They face increasing numbers of global competitors with lower costs of production. R&D should be seen as an investment in the future of the firm rather than a cost of doing business.

Universities

Universities perform 31 percent of Canada's R&D;[14] this contribution to national R&D is high compared to other countries.

Universities are key players in Canada's innovation system. They develop a highly qualified work force and perform the research that will fuel Canada's long-term competitiveness. They are collaborating with Canadian firms to develop new technologies and are an important source of new spin-off companies.

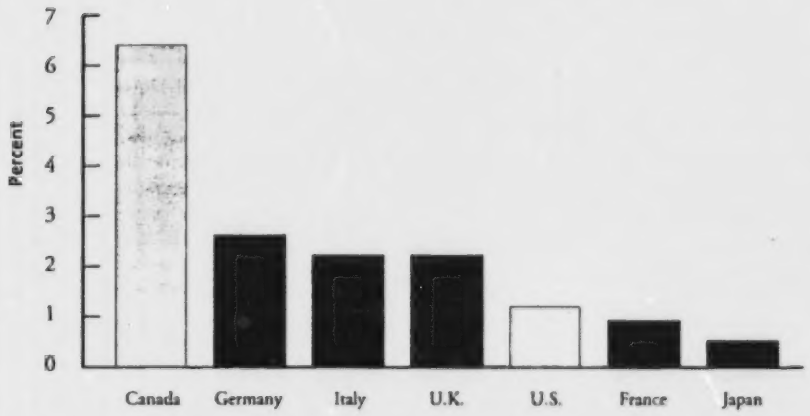
Universities play an important role in stimulating innovation in all countries, but their ties to the private sector make them a particularly important player in Canada. Canadian firms contract out over 6 percent of their R&D to universities — well above levels in other G-7 countries (Chart 11). The strong tie between firms

12. Industry Canada estimates based on (unpublished) Statistics Canada (88-202-XIB) data, 2000.

13. OECD, *Science, Technology and Industry Scoreboard*, 2001.

14. OECD, *Main Science and Technology Indicators*, 2001:2.

Chart 11: Share of Industry-Funded R&D Performed in Universities, 2000*



*Canada (2000), France (1999), Germany (1999), Italy (1998), Japan (1998), U.K. (1998), U.S. (1999).

Source: OECD, *Basic Science and Technology Statistics*, 2000.

The R-2000 Home

North America's first cost-effective, energy-efficient home, the R-2000, was a joint effort of the University of Saskatchewan and Natural Resources Canada. A professor of mechanical engineering developed the first heat-recovery ventilator. The system recovers the energy from stale exhaust air and uses it to warm the fresh air coming into the house, resulting in better air quality. The system has been especially beneficial for people with asthma or allergies. The Natural Sciences and Engineering Research Council of Canada has also supported the professor's research throughout his career.

and academia in Canada reflects the private sector's need to access scientific knowledge that it does not possess in order to remain competitive, and universities' desire to diffuse their knowledge in ways that result in social and economic benefits for Canadians.

Most countries believe that their innovation potential is strengthened by a sustained commitment to funding university research, and Canada is no exception. The Government of Canada has invested significantly in university research in recent years and is committed to unleashing the full potential of universities.

University research is crucial to the education of the next generation of researchers and highly qualified people. According to the Association of Universities and Colleges of Canada, universities face a projected 20–30 percent increase in enrolment over the next decade. At the same time, nearly two thirds of current faculty will retire. As many as 30 000 faculty members will need to be recruited from Canada and abroad. This will occur as international competition for highly skilled workers increases. Younger faculty members, most of whom will have been trained in a research-intensive environment, expect to conduct research. Adequate research funding will, therefore, be essential for Canada to develop, attract and retain top quality faculty — and train the next generation of highly qualified people.

Another critical challenge for the university community is that funding has not kept pace with a research endeavour that has become increasingly complex and sophisticated. Research today is characterized by teams that operate globally and under increased demands (e.g. animal care, human ethics and environmental assessment). The costs associated with these new demands, often termed the "indirect" costs of research, are not fully covered by federal or provincial/territorial governments. Researchers in the U.S. and U.K. have had these costs covered for many years.

BEST COPY AVAILABLE

© Photo courtesy of Canada's SchoolNet

Reports by the Prime Minister's Advisory Council on Science and Technology concluded that the Government of Canada should support a greater share of the cost of the research that it sponsors, recognizing the relatively higher costs of smaller universities. Small universities provide a similar range of research infrastructure with fewer resources. The challenge for smaller universities, however, is not to replicate the diversity of larger universities, but to strategically position themselves in specialty areas and lever their relatively scarce resources for maximum impact. Budget 2001 took initial steps to support the indirect costs of research by providing a one-time investment of $200 million. The government will need to work with the university community to define the basis for ongoing support.

University research results are often published in academic journals, contributing to the global knowledge pool. Canada has reason to be proud of its post-secondary institutions. We perform comparatively well in scientific papers generated for every million dollars invested in research. The high quality of these papers is clear given the frequency with which Canadian research is cited in other countries' work.

Security Enhancing Innovations

A Canadian mechanical engineering professor at the University of New Brunswick is developing new technologies for detecting materials that pose a threat to security, safety, health and the environment. His newest device produces three-dimensional images of concealed objects in items such as luggage and cargo. These imaging systems were developed with the help of the Natural Sciences and Engineering Research Council of Canada.

BEST COPY AVAILABLE

© Photo courtesy of Technology Partnerships Canada

Canadian investments in university research, both private and public, are also generating economic benefits. In 1999 Canadian universities and research hospitals earned $21 million in royalties, held $55 million in equity, generated 893 invention disclosures, were issued 349 new patents and executed 232 new licences.[15] To date they have spun off as many as 818 companies, posting a strong record relative to the U.S.[16] The Association of University Technology Managers estimates that the commercialization of academic research in Canada resulted in more than $1.6 billion in sales and supported more than 7300 jobs in 1999.[17] The evidence suggests that universities can contribute to economic growth and benefit from industrial funding without compromising their role as key performers of basic research, and without compromising their ability to disseminate results widely through publishing.

A comparison of the 139 U.S. and 20 Canadian universities that report to the Association of University Technology Managers suggests that there is still room for improvement. Although the U.S. universities perform about 14 times as much research as their Canadian counterparts, they receive 49 times as much licensing income — a key indicator of the value of innovations.[18] Recommendations by the Advisory Council on Science and Technology centred on the need for the government to provide financial support to enable universities to increase their level of effort.

In return, universities need to focus on areas of excellence, train greater numbers of highly qualified people in the skills required by the private sector and government, and more aggressively seek out commercial applications for publicly funded research. Key commercialization performance outcomes should at least triple over the next decade. This will require the development of long-term innovation strategies, supported by stretch goals and targets. It will require clear intellectual property policies, and aggressive efforts to develop the technology transfer practitioners that are in short supply. Most important, it will require a serious commitment to ensuring that, whenever possible, Canadians benefit from the public investment in research. Universities need to be held more accountable for reporting on the benefits that accrue to Canadians from the very substantial annual public investment in research.

15. Statistics Canada, *Survey of Intellectual Property Commercialization in the Higher Education Sector*, SIEDD Working Paper ST-00-01, Cat. No. 88F0006XIB-00001, 1999.

16. Denys Cooper, National Research Council Canada, Industrial Research Assistance Program, 2001.

17. Association of University Technology Managers, Inc., *AUTM Licensing Survey: FY 1999*, 2000.

18. Association of University Technology Managers, Inc., *AUTM Licensing Survey: FY 1999*, 2000.

Governments

Governments perform about 11 percent of Canada's R&D. This is comparable to the average for OECD countries.[19] There are approximately 200 Government of Canada R&D laboratories with a $1.7-billion research budget and 14 000 research scientists and engineers.[20]

Over much of the 20th century, a high level of government R&D was necessary because there was little university or private sector R&D. Today, Canada enjoys a strong system of universities, and our private sector has one of the fastest rates of growth in expenditures on R&D in the G-7. In response, the government has focused its efforts in areas where its R&D needs cannot be met by others. In the area of public interest (e.g. health and safety, environment and stewardship of natural resources) governments are the agents charged with the duty of carrying out or funding the research upon which sound regulatory policies rely. Governments also have key roles to play as builders, holders and facilitators of a research infrastructure that supports Canada's innovation system.

Over the past several years, the Council of Science and Technology Advisors has been examining the role of the Government of Canada's laboratories in Canadian society. Their studies have shown that the government's system has many strengths. It is responsible for Canada's outstanding record on public health and safety, it has established a strong system of industrial standards, and it has built infrastructure that supports economic development. Historically, several sectors of the Canadian economy have depended heavily on the government for R&D, notably the agriculture and fisheries sectors.

The R&D performed by the Government of Canada, as measured by research papers published or the extent to which these papers are used by other researchers, is high quality and productive relative to other countries. In a number of specialized areas, including natural resources and the environment, the greatest concentration of research expertise in Canada is located within the government's laboratories.

When the research has commercial potential, departments actively seek out private sector partners to take their discoveries to market. In 1999 alone, the government was issued 89 patents, granted 191 licences and received $12 million in royalties.[21] Government of Canada laboratories have spun off 48 new companies to date and outperform U.S. government laboratories (relative to the size of our research base) in terms of royalties, new licences and patent applications.[22]

19. OECD, *Main Science and Technology Indicators*, 2001:2.

20. Statistics Canada, *Science Statistics*, Cat. No. 88-001-XIB, Vol. 25, No. 9, November 2001.

21. Statistics Canada, 1999, Federal Science Expenditures and Personnel 1999/2000, Intellectual Property Management, fiscal year 1998/99.

22. Industry Canada based on: Statistics Canada, 1999, Federal Science Expenditures and Personnel 1999/2000, Intellectual Property Management, fiscal year 1998/99; and U.S. Department of Commerce.

UV Index and Prediction Program

Government scientists developed the UV Index to help Canadians gauge the strength of ultraviolet radiation and take precautions against sunburn. The UV Index is calculated from data collected at 13 monitoring sites across Canada. The Canadian Meteorological Centre uses these data to issue nation-wide daily forecasts of the next day's UV Index. This program has set a global standard. The Government of Canada granted a licence to manufacture the necessary equipment to a Canadian firm, which is now selling the equipment around the world.

BEST COPY AVAILABLE

Key Roles for Government Science and Technology

Support for decision making, policy development and regulations:

- *Environment Canada's research activities support its ability to develop policies and enforce regulations on environmental protection and quality.*
- *Health Canada's Health Products and Food Branch carries out research to ensure the safety of drugs and food, as well as the safe implementation of new health-related technologies.*

Development and management of standards:

- *The National Research Council Canada's Institute for Research in Construction provides research, building code development, and materials evaluation services.*

Support for public health, safety, environmental and/or defence needs:

- *The Canadian Science Centre for Human and Animal Health in Winnipeg is the first facility in the world to accommodate research into established and emerging diseases in humans and animals at the highest level of biocontainment.*
- *Defence R&D Canada not only supports research into new technology for Canada's military, but also develops and adapts technologies that improve the security and safety of Canadians.*

Enabling economic and social development:

- *The Research Institutes of the National Research Council Canada form the nuclei of technology clusters in areas such as biotechnology, aerospace, fuel cells and nanotechnology across Canada.*
- *Agriculture and Agri-Food Canada supports research with the private sector that is readily transferable to the client for the generation of new business and economic growth.*

Source: Council of Science and Technology Advisors, *Building Excellence in Science and Technology: The Federal Roles in Performing Science and Technology*, Ottawa, 1999.

BEST COPY AVAILABLE

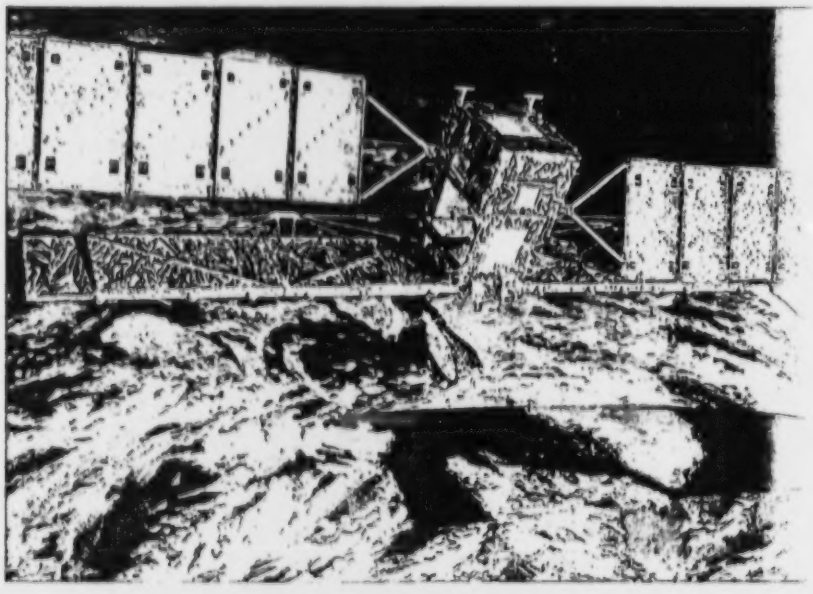
Help from Space

Environment Canada's Ice Service and Natural Resources Canada's Centre for Remote Sensing performed the R&D that led to the operational use of RADARSAT-1 data for sea ice monitoring. The transition from aerial reconnaissance to the Canadian Space Agency's RADARSAT-1 satellite improved the quality and coverage of the sea ice monitoring service, while saving over $6 million per year.

As has been noted by the Council of Science and Technology Advisors, government laboratories face a number of significant challenges. Renewal of an ageing researcher population will be a pressing issue over the next decade. As knowledge continues to advance in areas such as biotechnology, the skills required to provide government with the knowledge necessary to take sound decisions are changing rapidly. Not only is there a need for renewal because of demographics, but there is also a need for new skills because of advances in knowledge.

The government's ability to protect health, safety and other public interests increasingly depends on access to high-quality scientific knowledge. Governments need a deep and broad understanding of the latest breakthroughs and their potential impacts on people and their environment. The public and the business community need to be confident that governments are keeping up with current developments in science.

It may be appropriate to consider new partnership models across government departments, and including other R&D players, to address key emerging issues such as security and water safety. Stronger networks among government, academia and private sector researchers would enable the government to benefit from the best expertise the country has to offer.



Courtesy Canadian Space Agency
© Canadian Space Agency 2002 www.space.gc.ca

BEST COPY AVAILABLE

Strategic Alliances

Innovation can be both risky and costly, and often requires expertise from outside the firm. The pooling of resources, expertise and risk is particularly important for smaller firms. Beyond mitigating risk, alliances enable firms to reduce research costs and to access new markets. Canada's more innovative firms form collaborative alliances with public and private sector organizations at home and abroad.[23] They range from informal sharing of information, to structured strategic alliances within the country, to international alliances with suppliers, customers and even competitors.

The Conference Board of Canada, in its second annual innovation report, confirmed that "firms that collaborate are more likely to draw a higher share of revenue from the sale of new products. These firms are significantly more likely to introduce breakthrough (world-first) innovations."

In general, Canadian firms have a strong international track record in forming strategic alliances for joint marketing and sales activities. Compared to our competitors, however, Canadian firms form fewer of the alliances that are key to the development of new technologies (Chart 12). Technology alliances involve the pooling of resources to reduce the risks and costs inherent in innovation.

According to The Conference Board, large firms are well advanced in terms of their level of collaboration. Small and medium-sized enterprises, however, face particular challenges given the management time required to develop alliances while dealing with the day-to-day demands of running a successful business. Governments can play a role in facilitating more alliances, but the private sector must take the lead in recognizing and acting on opportunities to benefit from the best science and expertise the world has to offer.

Venture Capital

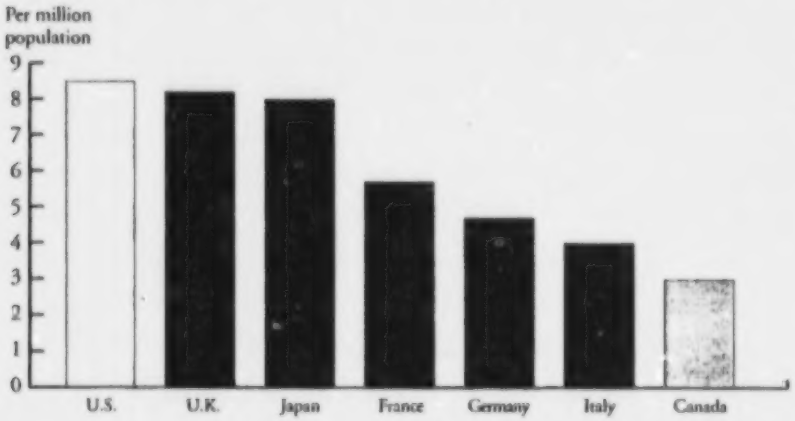
Venture capital investments are typically placed in smaller firms to support and accelerate the commercialization of new technologies. In keeping with global trends, Canada's venture capital industry has shown strong growth in recent years (Chart 13). In 2000, total capital under management reached an impressive $19 billion. This represents the value of current plus past year investments and commitments by Canadian venture capitalists.

Incremental venture capital investments in Canada amounted to $6.6 billion in 2000 alone (annual disbursements). Disbursements have grown at a compound annual rate of 56 percent since 1994.

As expected, with the recent downturn in the economy, venture capital investments will likely be lower in 2001. Preliminary data for the first nine months suggest that an additional $5 billion will have been invested in Canada in 2001 — below the 2000 peak, but still well above the 1999 level. The U.S. is expected to drop to below the level it posted in 1999.

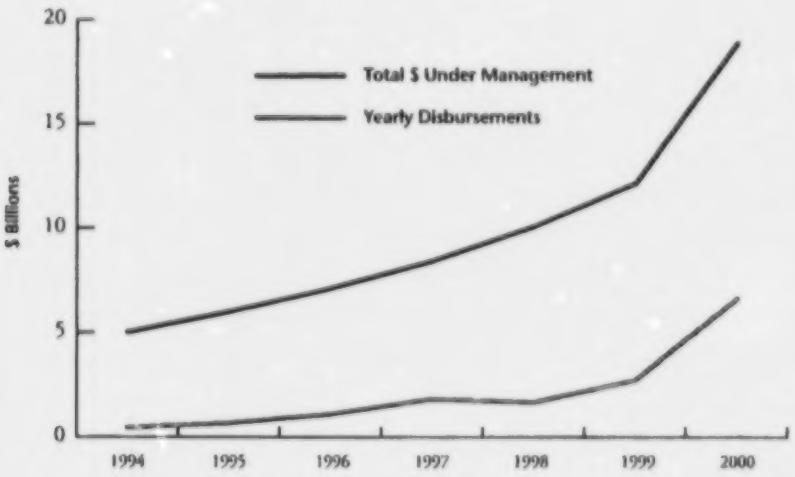
23. Statistics Canada, *Survey of Innovation, 1999.*

Chart 12: Technological Alliances Between Firms, 1989–98

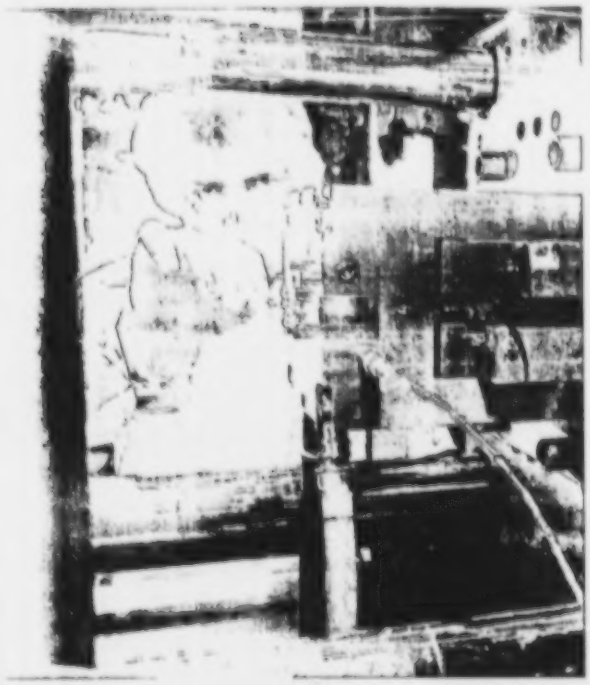


Source: Data estimated from the Maastricht Economic Research Institute on Innovation and Technology (MERIT) as cited in Department of Trade & Industry, *UK Competitiveness Indicators, second edition*, 2001.

Chart 13: Canadian Venture Capital Trends



Source: Macdonald & Associates Limited, *Summary of Venture Capital Investment Activity, 1994–2000.*



© Photo courtesy of Technology Partnerships Canada

Canada appears to be narrowing the gap with the U.S. in terms of venture capital invested per capita. The U.S. per capita investment was $349 more than that of Canada in 2000, dropping to only $53 more in the first nine months of 2001.[24] Canada also performs well internationally in terms of venture capital investments relative to the size of our economy.[25]

The Canadian venture capital market, however, remains proportionately smaller than its American counterpart. The more mature, experienced and competitive venture capital industry in the U.S. makes it easier for American firms to secure larger capital investments to commercialize scientific discoveries and support their company's growth over a longer time frame than is generally the case in Canada. This has contributed to the United States' remarkable success in innovation.

Canadian firms with rapid growth potential will increasingly demand specialized services and longer-term support from venture capitalists — Canadian and foreign. The Canadian venture capital industry needs to respond by developing specialized management expertise in emerging fields. Complex scientific and technological developments are making it increasingly difficult for the industry to evaluate market opportunities and risks without such specialized expertise.

The Canadian industry also needs to tap into new sources of capital. Pension funds could play a more significant role. Canadian pension funds typically accounted for 5–10 percent of all new venture capital investments in Canada. In 2000, their share rose significantly to 22 percent. Despite this gain, they remain a less important player than U.S. pension funds, which account for 50 percent of disbursements.

We are beginning to witness an increased foreign component to venture capital investment — both in terms of investments by foreign venture capitalists in Canadian firms and by Canadian venture capitalists in foreign firms. This is a positive development. Canadian firms will benefit from increased competition among venture capitalists, and the Canadian venture capital industry will be able to develop more specialized expertise as it seeks out global niche markets.

24. Industry Canada caculations based on Macdonald & Associates Limited, *Venture Capital Activity 2000*, March 2001, and National Venture Capital Association (http://www.NVCA.com).

25. The Conference Board of Canada, *Investing in Innovation: 3rd Annual Innovation Report*, 2001.

Addressing the Knowledge Performance Challenge

The private sector needs to strengthen its ability to develop innovations for world markets and adopt leading-edge innovations from around the world. Relatively low levels of investment in R&D, too few strategic technology alliances and limited pools of risk capital contribute to the private sector's relatively lackluster innovation performance. Addressing these challenges is critical to the competitiveness of the private sector and requires leadership by the private sector.

Governments also require access to a strong knowledge base in order to carry out stewardship responsibilities, inform policy development, and meet economic development and social objectives. Governments need to work with academic institutions to increase the supply of research personnel in Canada and the stock of knowledge.

It is not enough, however, for governments and academia to increase the supply of researchers and the knowledge they generate. The private sector in Canada must demand, purchase, perform and, ultimately, use more research to fuel its competitiveness. Firms also need to continually search out and implement best practices from across the country and around the world in business financing, marketing and production. This will require a cultural shift in behaviours and attitudes. It will require a much more aggressive approach to managing and extracting value from knowledge.

GOALS, TARGETS AND PRIORITIES

To address these challenges, the public and private sectors in Canada need to identify long-term goals and measurable targets that can guide all of our efforts over the coming decade. Some of the goals and targets proposed by the Government of Canada have been previously announced in the 2001 Speech from the Throne, federal budget and ministerial speeches. Others are proposed for the first time. Together, they respond to the need for more firms to develop and adopt leading-edge innovations, in part through increased investment in the creation of knowledge, more strategic alliances and improved access to risk capital.

GOALS

- Vastly increase public and private investments in knowledge infrastructure to improve Canada's R&D performance.
- Ensure that a growing number of firms benefit from the commercial application of knowledge.

TARGETS

- By 2010, rank among the top five countries in the world in terms of R&D performance.
- By 2010, at least double the Government of Canada's current investments in R&D.
- By 2010, rank among world leaders in the share of private sector sales attributable to new innovations.
- By 2010, raise venture capital investments per capita to prevailing U.S. levels.

GOVERNMENT OF CANADA PRIORITIES

1. **Address key challenges for the university research environment.**

   Priority: The 2001 federal budget increased the annual budgets of Canada's three national research granting councils. The budget also provided a one-time investment to help universities and research hospitals cover the indirect costs of federally sponsored research. These measures will alleviate short-term financial pressures. The granting councils will, however, require enhanced funding over the longer term. The indirect cost pressures facing our universities and research hospitals are structural issues that also require a long-term solution. To address these challenges, the Government of Canada has committed to implementing the following initiatives:

- **Support the indirect costs of university research**. Contribute to a portion of the indirect costs of federally supported research, taking into account the particular situation of smaller universities.

- **Leverage the commercialization potential of publicly funded academic research**. Support academic institutions in identifying intellectual property with commercial potential and forging partnerships with the private sector to commercialize research results. Academic institutions would be expected to manage the public investment in research as a strategic national asset by developing innovation strategies and reporting on commercialization outcomes. An evolving partnership would see universities more aggressively contributing to innovation in Canada, in return for a long-term government commitment to their knowledge infrastructure.

- **Provide internationally competitive research opportunities in Canada**. Increase support to the granting councils to enable them to award more research grants at higher funding levels. Excellence must remain the cornerstone of federal support for university research.

2. **Renew the Government of Canada's science and technology capacity to respond to emerging public policy, stewardship and economic challenges and opportunities.**

   Priority: In addition to providing traditional support for government science, the Government of Canada will consider a new approach to investing in research in order to focus federal capacity on priority, emerging science-based issues. New investments in scientific research would ensure that

A Model: Canada Institute for Nanotechnology

The Institute, a $120-million initiative of the federal and Alberta governments, will bring Canada to the forefront of nanotechnology. This field has the potential to revolutionize such areas as health care, computer and energy use, and manufacturing. The Institute will broaden existing networks by offering internship opportunities to post-graduate researchers, and by making its facilities available to other organizations.

BEST COPY AVAILABLE

sound science-based policies are adopted to support environment, health and safety objectives. The government would build collaborative networks across government departments, universities, non-government organizations and the private sector. This approach would integrate, mobilize and build on recent government investments in universities and the private sector. Funding would be competitive, based on government priorities and informed by expert advice.

3. **Encourage innovation and the commercialization of knowledge in the private sector.**

   Priority: The private sector is the central player in the nation's innovation system. In addition to creating a supportive policy and regulatory environment for innovation (see Section 7), the government will consider making specific enhancements to programs that encourage innovation by the private sector:

- **Provide greater incentives for the commercialization of world-first innovations**. The Government of Canada will consider increased support for established commercialization programs that target investments in biotechnology, information and communications technologies, sustainable energy, mining and forestry, advanced materials and manufacturing, aquaculture and eco-efficiency.

- **Provide more incentives for small and medium-sized enterprises (SMEs) to adopt and develop leading-edge innovations**. The Government of Canada will consider providing support to the National Research Council Canada's Industrial Research Assistance Program to help Canadian SMEs assess and access global technology, form international R&D alliances, and establish international technology-based ventures. In keeping with the recommendations of the Advisory Council on Science and Technology, this would help SMEs spread the risks inherent in the commercialization and diffusion of new technologies.

- **Reward Canadian innovators**. The Government of Canada will consider implementing a new and prestigious national award, given annually, to recognize internationally competitive innovators in Canada's private sector. Celebrating successes will help to create a culture of innovators.

- **Increase the supply of venture capital in Canada**. The Business Development Bank of Canada (BDC) will use its expertise and knowledge of venture capital funds to pool the assets of various partners, pension funds in particular. The BDC would invest these proceeds in smaller, specialized venture capital funds and manage the portfolio on behalf of its limited partners.

THE SKILLS CHALLENGE

To succeed in the global, knowledge-based economy, a country must be capable of producing, attracting and retaining a critical mass of well-educated and appropriately trained people. Highly qualified people — defined as people having completed a post-secondary degree or diploma or its equivalent — are indispensable to an innovative economy and society.

Canada has one of the most highly educated labour forces in the world. Close to 40 percent of the adult population has completed a post-secondary education, well ahead of other advanced economies (Chart 14). Close to 285 000 diplomas, degrees and certificates were granted in 1998 by our 199 colleges and 75 universities, including some 4000 doctorates.[26] This is a very strong and enviable base upon which to build a successful innovation strategy.

Over the years, our supply of highly qualified people has been sufficient to sustain economic growth and has been instrumental in attracting foreign investment. In a recent survey of senior American executives, the quality and availability of our work force were cited as the main reasons to invest in Canada (Chart 15).

The current economic environment has led to lay-offs in a number of fields, particularly in the information and communications sector. This is a short-term issue.

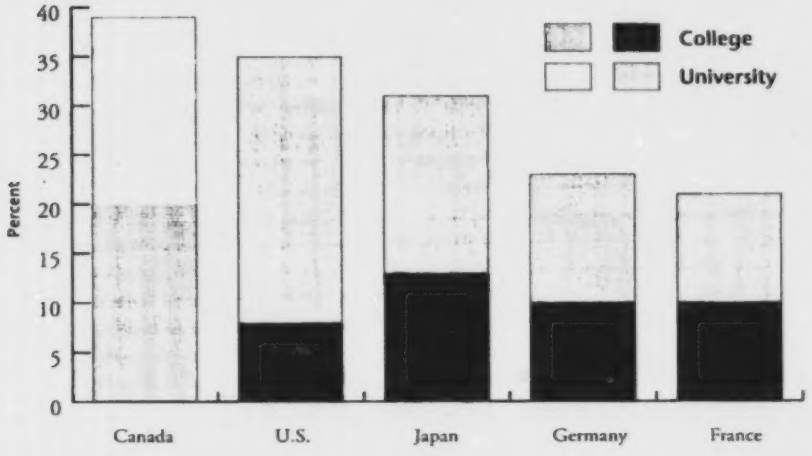
In the longer term, Canada could face major skills shortages. The Advisory Council on Science and Technology reported that firms in many different sectors are already experiencing difficulties in recruiting and retaining highly skilled workers in specialized areas. These challenges will grow and become more generalized in the future.[27]

26. Statistics Canada, *Education in Canada*, 2000.

27. Expert Panel on Skills of the Advisory Council on Science and Technology, *Stepping Up — Skills and Opportunities in the Knowledge Economy*, 2000.

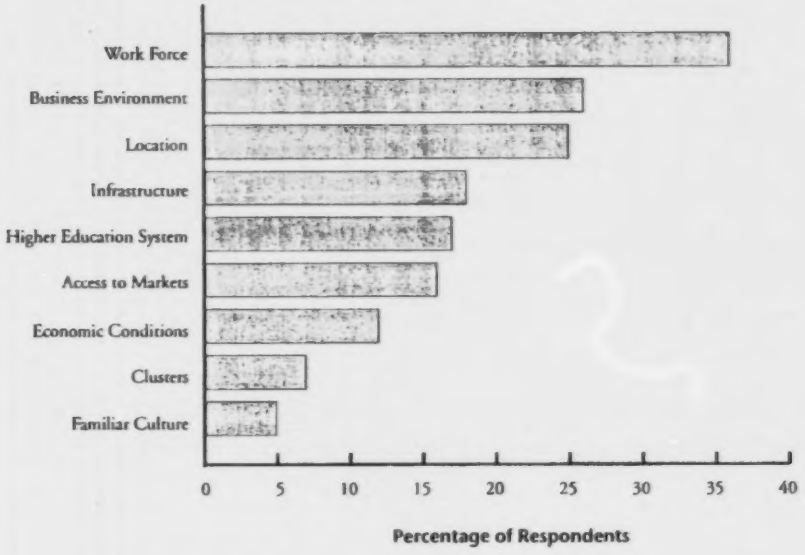
BEST COPY AVAILABLE

Chart 14: Percentage of the Population Aged 25 to 64 That Has Completed Post-Secondary Education, 1999



Source: OECD, *Education at a Glance — OECD Indicators*, 2001.

Chart 15: Main Reasons for Investing in Canada



Source: Wirthlin Worldwide and Earnscliffe Research and Communications, 2001.

A key reason for this is that all Western countries are beginning to experience major demographic changes — ageing populations and declining birth rates — that will result in fewer workers relative to the size of the population not in the labour force. At the same time, the demand for high-level skills will continue to increase rapidly in all sectors. Under these conditions, it is reasonable to expect that the competition for highly skilled workers will intensify not only within Canada, but also in the international labour market.

This will make it particularly challenging for Canada to reach its goal of becoming one of the top five countries for R&D performance by 2010. To perform R&D at that higher level we must more than double the number of research personnel in our labour force.[28] Canada needs to develop more scientists, engineers and highly skilled technicians. But we also need to augment our "management class" — people with business skills and broad interdisciplinary backgrounds. If Canada is to become one of the most innovative economies in the world, we need strong managers who can lead the economy through a business transformation.

Addressing potential skills shortages is one of Canada's greatest challenges in the coming decade. *Achieving Excellence: Investing in People, Knowledge and Opportunity* focuses on developing and maintaining a sufficient supply of highly qualified people to drive innovation. *Knowledge Matters: Skills and Learning for Canadians* addresses the need to strengthen the foundation for lifelong learning for children and youth, maintain excellence in Canada's post-secondary education system, build a world-class learning system for adults and help immigrants achieve their full potential. It addresses a broader range of areas where Canada must improve in order, for example, to increase the number of skilled tradespeople and apprentices, reduce high-school drop-out rates and improve literacy. Advances in these areas will not only strengthen Canadian society, but also help Canada become more innovative over the longer term.

Canada can address its skills challenge by substantially increasing the number of highly qualified people from three sources: new graduates from Canadian universities and colleges; highly qualified immigrants coming to Canada as permanent residents or temporary foreign workers; and people already in the labour force who retrain or upgrade their skills.

28. Industry Canada estimate.

NEW GRADUATES

Over the past decade, full-time university enrolments (as a proportion of age cohorts) have been growing slowly,[29] while part-time enrolments have sharply declined.[30] Without a substantial increase in the proportion of young Canadians undertaking post-secondary studies and going on to obtain the graduate degrees that the labour market demands, Canada will not be able to fully seize the opportunities that the new economy offers.

Promising students will not be able to pursue degrees in adequate numbers if we do not maintain and grow the teaching capacity in our universities and colleges. These institutions are facing an unprecedented loss of teachers and researchers due to retirements, and this will continue over the next 10 years.

29. Council of Ministers of Education, Canada and Statistics Canada, *Education Indicators in Canada: Report of the Pan-Canadian Education Indicators Program, 1999*, 2000.

30. Association of Universities and Colleges of Canada, "The part-time enrolments: where have all the students gone?" *Research File*, May 1999.

Photo courtesy of National Research Council Canada.

Post-secondary institutions in many other countries, including the U.S., are facing the same demographic pressures. This is exacerbating competition for new faculty and R&D personnel. As noted in Section 5, internationally competitive levels of research funding will play an important role in attracting and developing top-quality faculty.

International students are another source of highly qualified people. They bring an international perspective to campuses, and add intellectual and cultural diversity to classrooms. They represent a significant economic benefit, not only for the receiving institutions, but also for local communities. Once they return home, they can become decision makers or trade partners with an affinity for Canada. They can also be an attractive source of skills for Canadian employers, should they choose to become permanent residents. Canada needs to improve its ability to attract top international students.

IMMIGRATION

Immigration has always been a major source of qualified workers for Canada. As previously noted, the international market for highly skilled workers is becoming very competitive. Many industrialized countries, particularly the U.S., are implementing deliberate strategies to attract the skills that are in short supply, while "source countries" are beginning to put in place measures to reduce the outflow of their most highly qualified citizens.

Canada's approach to recruiting foreign qualified workers was conceived in a different era. It requires updating and modification to better suit our needs in the face of tough international competition for scarce talent. We must shift from a passive to a proactive approach and actively brand Canada as a destination of choice. Our efforts to secure the highly qualified people needed to fuel the Canadian economy must continue.

The new *Immigration and Refugee Protection Act*, and its accompanying regulations, will support that goal and build on partnerships with provinces and territories, which share responsibility for immigration. New Government of Canada selection criteria will take into account a wider range of attributes and competencies for skilled worker immigrants. To address short-term cyclical skills shortages due to growth in a sector or the introduction of new technologies, it will be possible to enter into agreements with groups of employers from the same industry to facilitate the entry of temporary foreign workers. The regulations will also make it easier for qualified temporary foreign workers to become permanent residents without having to leave Canada.

Canada benefits from the skills and abilities immigrants bring with them. Given the rising demand for skills and the strong competition for highly qualified people, Canada can ill-afford to waste any of this talent. One of the greatest challenges we face is building a comprehensive and effective system for assessing and recognizing foreign credentials. Assessment services are available in a number of provinces, but much remains to be done before we can be satisfied that, as a country, we are taking full advantage of the valuable skills that newcomers offer to Canada. *Knowledge Matters: Skills and Learning for Canadians* discusses in more detail the challenges and possible actions on foreign credential assessment and recognition.

Another challenge that we face is encouraging newcomers to settle in centres other than Toronto, Vancouver and Montréal. The benefits of immigration need to be more evenly distributed across the country. All stakeholders have an interest and a role to play in achieving this result.

THE ADULT LABOUR FORCE

The skills that people acquire once they are in the labour force are the third and arguably the most critical source of supply. Canada cannot count only on new graduates or new immigrants to maintain, let alone increase or improve, its stock of skills. The level and types of skills required by the economy are in a constant state of evolution, making it imperative that all workers and their employers invest in continual skills development. Continuous upgrading across the whole spectrum of workers' skills is essential if Canada is to address its skills challenge and avoid experiencing severe labour shortages in the coming years.

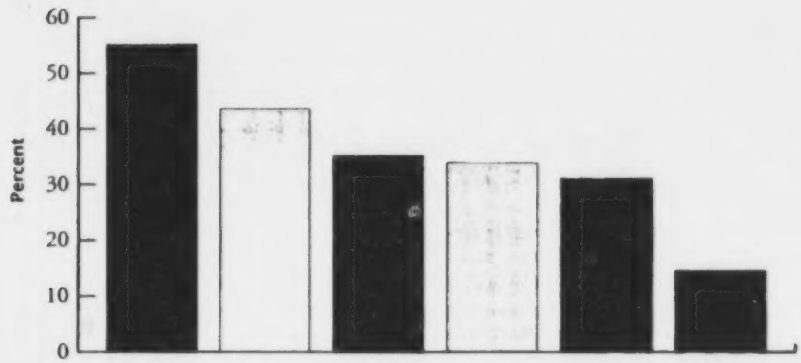
Adapting to Technological Changes in the Construction Industry

Local 183 of the Universal Workers' Union represents 25 000 construction workers from the Greater Toronto Area. The Union, working closely with employers, has placed continuous training at the core of its strategy. It built a 42 000 square-foot Life Long Training Centre in Vaughan, Ontario, the largest of its kind in North America. This state-of-the-art facility is used to upgrade the knowledge and specialized skills of experienced workers, and to train apprentices on the latest equipment and technology.

Canada's performance in adult training falls short of international standards (Chart 16). This holds true even for people with post-secondary credentials. Several factors combine to produce this relatively poor performance, including the prevalence in our economy of small firms, which typically have only limited time and resources to invest in skills development. Other factors include the absence of a strong tradition of workplace training, in part because Canada has not experienced sustained shortages of the skills required to fuel its economy.

Without increased and ongoing investments in skills upgrading, Canada's labour force will perform below its potential in dealing with the new demands of the knowledge-based economy. This will constrain our overall ability to develop innovations and apply them. These issues are addressed in greater detail in *Knowledge Matters: Skills and Learning for Canadians.*

Chart 16: Percentage of Employed Adults Aged 25 to 54 Participating in Employer-Sponsored Formal Job-Related Training, 1995



Source: OECD, *Employment Outlook*, 1999.

BEST COPY AVAILABLE

Addressing the Skills Challenge

Knowledge and innovation depend on people. We cannot become one of the world's most innovative countries without addressing the skills challenge — a challenge that will become more apparent as the economy recovers. We need to make investments to support advanced education, research and professional development. We must also ensure that talented Canadians and immigrants recognize Canada's special advantages as a place to live and work, and are able to perform to their full potential. The "Branding Canada" initiative proposed in Section 7 will contribute to this outcome, along with the following proposals.

GOALS, TARGETS AND PRIORITIES

The proposed goals, targets and federal priorities would help Canada to develop, attract and retain the highly qualified people required to commercialize and adopt leading-edge innovations.

GOALS

- Develop the most skilled and talented labour force in the world.
- Ensure that Canada continues to attract the skilled immigrants it needs and helps immigrants to achieve their full potential in the Canadian labour market and society.

TARGETS

- Through to 2010, increase the admission of Master's and PhD students at Canadian universities by an average of 5 percent per year.
- By 2002, implement the new *Immigration and Refugee Protection Act* and regulations.
- By 2004, significantly improve Canada's performance in the recruitment of foreign talent, including foreign students, by means of both the permanent immigrant and the temporary foreign workers programs.
- Over the next five years, increase the number of adults pursuing learning opportunities by 1 million.

GOVERNMENT OF CANADA PRIORITIES

1. **Produce new graduates.**

   Priority: The Government of Canada will consider the following initiatives to increase the number of students obtaining graduate and post-graduate degrees, help universities retain the best graduate students in Canada and attract top international students, and improve the quality of research training at the graduate level:

- Provide financial incentives to students registered in graduate studies programs, and double the number of Master's and Doctoral fellowships and scholarships awarded by the federal granting councils.

- Create a world-class scholarship program of the same prestige and scope as the Rhodes Scholarship; support and facilitate a coordinated international student recruitment strategy led by Canadian universities; and implement changes to immigration policies and procedures to facilitate the retention of international students.
- Establish a cooperative research program to support graduate and post-graduate students and, in special circumstances, undergraduates, wishing to combine formal academic training with extensive applied research experience in a work setting, including government laboratories.

2. **Modernize the Canadian immigration system.**

   Priority: Brand Canada as a destination of choice; augment the number of highly skilled workers immigrating permanently to Canada; ensure that provinces, territories, municipalities and businesses get the skills they need when they need them; work with provincial/territorial partners and regulatory bodies to develop a national approach to the assessment and recognition of foreign credentials; and improve the integration of foreign qualified workers into the domestic labour market across the country. At the same time, it will be important to ensure the health, safety and security of Canadians.

   Knowledge Matters: Skills and Learning for Canadians proposes specific initiatives to improve the integration of immigrants, including the development of a national approach to foreign credential assessment and recognition.

   In addition, to attract highly skilled workers, the Government of Canada has committed to:

- Maintain its commitment to higher immigration levels and work toward increasing the number of highly skilled workers.
- Expand the capacity, agility and presence of the domestic and overseas immigration delivery system to offer competitive service standards for skilled workers, both permanent and temporary.
- Diversify our skilled worker base by branding Canada as a destination of choice through targeted promotion and recruitment in more areas of the world.
- Use a redesigned temporary foreign worker program and expanded provincial nominee agreements to facilitate the entry of highly skilled workers, and to ensure that the benefits of immigration are more evenly distributed across the country.

Canada's innovation environment is, in essence, the climate created by government stewardship regimes that protect the public interest, and encourage and reward innovation. Instruments such as legislation, regulations, codes and standards create the conditions necessary for Canadians to enjoy the social and economic benefits of innovative activities. They play a crucial role in establishing public confidence in the innovation system, and the business confidence that leads to investment and risk taking.

A truly world-class innovation environment suffers no trade-off between the public interest and business opportunity. It recognizes that the public interest must be protected. It recognizes that innovation cannot be sustained without a public that has been well served by innovation in the past and that demands more.

Canada's innovation environment is strong. Our stewardship policies and systems that protect health, environment, safety, privacy and consumer rights are among the world's best. They take a modern and progressive approach. They enable Canadians to take advantage of innovations, while remaining confident that their well-being is protected.

E-Commerce at the Intersection: Protecting the Public Interest and Promoting Innovation

In the late 1990s, the Government of Canada recognized the emerging importance of e-commerce and the new stewardship challenges that it posed. Through cooperative efforts with industry and non-government organizations, the government developed and introduced the "seven firsts" to provide an appropriate policy framework for the development of this innovative way of doing business:

- *tax neutrality between e-commerce and conventional transactions*
- *standards*
- *public key infrastructure*
- *digital signatures*
- *security/encryption*
- *consumer protection*
- *privacy policy.*

THE INNOVATION ENVIRONMENT CHALLENGE

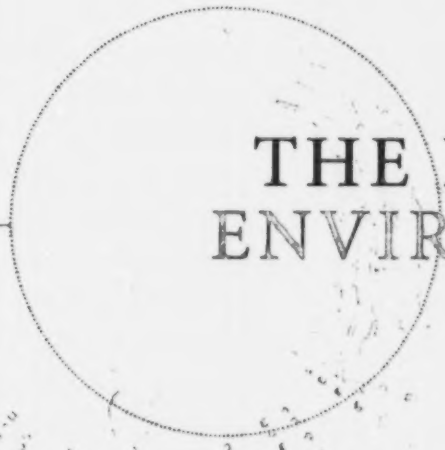


Photo courtesy of National Research Council Canada

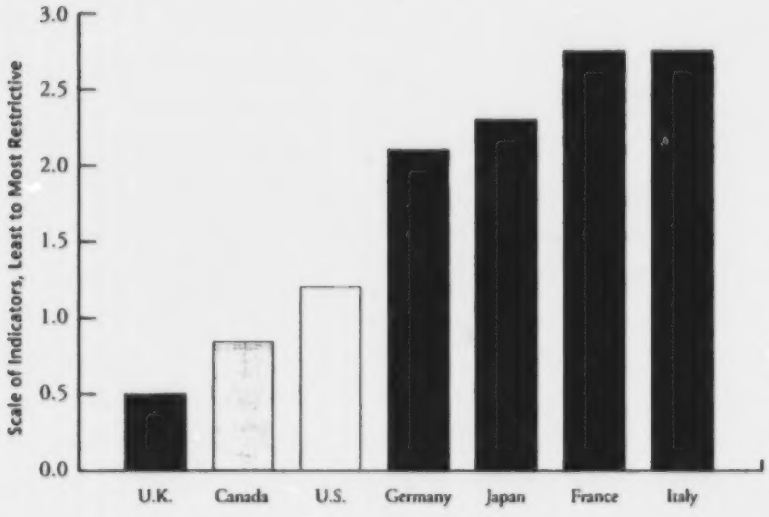
BEST COPY AVAILABLE

The innovation environment also encourages innovation and entrepreneurship in the private sector. For example, regulatory barriers to entrepreneurship in Canada are the lowest among OECD countries, with the exception of the U.K. (Chart 17). Our particular strength lies in the clarity of our regulations and administration, relatively low paper burden for business, lower barriers to competitiveness, and the openness of our processes.

Ongoing reductions in personal and corporate income tax rates, reductions in employment insurance premiums, favourable treatment of employee stock options, and generous R&D tax credits also support innovation. Owing in part to these strengths, Canada is seen as having strong prospects for medium-term economic growth.

Although many aspects of Canada's innovation environment are among the world's best, we cannot afford to rest on our accomplishments to date. Other countries are refining their policies to ensure the best positioning possible on the global stage. We too must act on opportunities to improve our innovation environment so Canadians can benefit from new scientific and technological breakthroughs while being assured that their health, safety and environment are protected. If we do not, public and business confidence will suffer, inhibiting our innovation performance.

Chart 17: Regulatory Barriers to Entrepreneurship,* 1998



*Total of administrative burdens on start-ups, barriers to competition, and regulatory and administrative opacity.

Source: OECD, *Summary Indicators of Product Market Regulation with an Extension to Employment Protection Legislation*, Economic Department Working Papers, No. 226, 2000.

The challenge for governments is to anticipate future changes brought on by international and domestic forces — to maximize the commercial potential for innovation while protecting public health and safety and the quality of the environment. The same forces that are challenging firms and universities to embrace new ways of doing business are posing equally large challenges for government:

- *New knowledge extends capabilities.* Governments need a profound understanding of capabilities created by new technologies, and of what is known and not known about their broader impacts on people, communities and the environment. Good public policy is built on this understanding.
- *The pace of innovation is accelerating.* Governments need to respond in a timely fashion to demand for innovations (e.g. the latest breakthroughs in health care), while ensuring their efficacy and safety.
- *Globalization poses challenges and opportunities on many fronts.* The wide array of goods and services entering the Canadian market is straining governments' capacity to respond to public and business needs. Global competition for investment and highly qualified people is requiring governments to compete against each other for investment and talent in such areas as tax competitiveness, quality of the labour force, health care, and community-based quality of life. Meanwhile, global challenges such as climate change and disease control are requiring increased international cooperation among governments.

STEWARDSHIP: PROTECTING THE PUBLIC INTEREST

A primary government responsibility is to protect and promote the public interest. Key tools for fulfilling this role include legislation, regulations, codes and standards. Other emerging tools could include economic instruments such as tradable emission permits. Taken together, these stewardship instruments help governments respond to health, environment, safety and privacy concerns. They also offer direction for public and private sector conduct.

Public policy is increasingly informed and driven by developments in science and technology. There are few areas of policy where science and technology do not play a role either as a source of public concern or as a potential solution to pressing problems. Innovation extends our capabilities and allows us to do things we have never been able to do before. Ensuring that we use these capabilities wisely, safely, and equitably is the role of good stewardship.

Canada has a strong record in promoting innovation while protecting the public interest. We must, however, be prepared to address challenges to our stewardship capacity that will emerge from new scientific developments.

Examples of Stewardship Regimes

- *Food safety*
- *Drug approvals*
- *Environmental protection*
- *Intellectual property rights*
- *Foreign ownership and investment regulations*
- *Competition policy.*

BEST COPY AVAILABLE

Stewardship in Action: Mine Environment Neutral Drainage Program (MEND)

Governments, the private sector and academia are working together to reduce acidic drainage from mine wastes, the most important environmental issue facing the Canadian mining industry today. Since its inception, MEND has allowed the Canadian mining industry to reduce environmental liabilities due to acidic drainage by at least $400 million, while improving the state of the local environment.

On the advice of the Council of Science and Technology Advisors, the Government of Canada is vigorously implementing recommended principles and guidelines to ensure the effective use of science and technology in decision making. Key elements of the proposed framework include:[31]

Early Issue Identification — anticipating public policy issues arising from new knowledge.

Inclusiveness — ensuring that advice is drawn from many disciplines, all sectors and, when appropriate, international sources.

Sound Science and Science Advice — applying due diligence to advice to ensure its quality, integrity and reliability.

Transparency and Openness — ensuring that processes are transparent, and that stakeholders and the public are consulted.

Review — keeping stewardship regimes up to date as knowledge advances.

Most developed countries have put in place independent bodies to clarify what is known and unknown with respect to the potential impact of scientific and technological developments (e.g. the Royal Society in the U.K., the Académie des sciences in France, and the National Academies in the U.S.). They provide balanced and informed advice on a suitable course of action. Assessments are informed by a multidisciplinary approach and are open to all stakeholders.

31. Government of Canada, *A Framework for Science and Technology Advice: Principles and Guidelines for the Effective Use of Science and Technology Advice in Government Decision Making*, Ottawa, 2000.

Photo courtesy of Agriculture and Agri-Food Canada

BEST COPY AVAILABLE

In Canada, many organizations, such as the Royal Society of Canada, the Advisory Council on Science and Technology and the Canadian Biotechnology Advisory Committee, provide expert advice based on the broad and varied knowledge of their members. However, Canada is one of the few countries in the industrialized world that does not have a national organization that represents and reflects the full range of science and technology assets. With this standing capacity in place, governments would have access to a source of expert assessments of the science underlying pressing new issues and matters of public interest.

Most countries face similar stewardship challenges. They must regulate virtually the same products. They face the same issues with respect to privacy and inappropriate content on the Web. They must all protect their people and their farm products from diseases — many of which spread rapidly throughout the world. Increasingly, countries are seeking common solutions to these stewardship challenges.

"The European Commission will propose *increased centralization of drug approvals, with more new products being submitted to the European Medicines Evaluation Agency in London. It is also seeking new 'fast track' powers to speed approval of medicines aimed at poorly treated diseases."*

Source: *Financial Times*, July 18, 2001

Canada can learn from, and modify for its own circumstances, the practices of other nations. Canada's stewardship policies would be strengthened to deal with emerging challenges by substantive comparisons and benchmarking against major international competitors. We can also participate in international partnerships to share scientific research and analysis on common regulatory issues.

Systematic, expert review of our stewardship regimes could enable Canada to benefit from the collective wisdom of experts from around the world, learn from the experiences of other countries and, where appropriate, develop shared approaches to common problems. Rigorous assessments of Canada's stewardship regimes would extend our options, and enable us to meet future social objectives under optimal conditions for administration and compliance. In the end, the goal remains the same: to ensure the health and safety of Canadians.

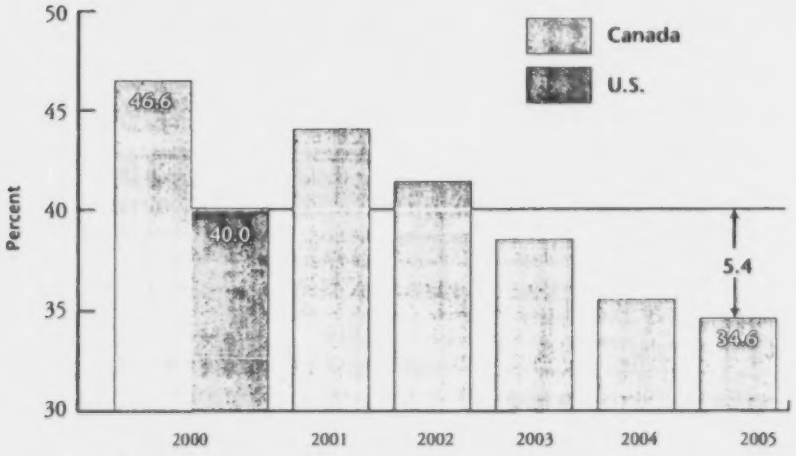
Competitive levels of business taxes are a critical factor to encourage investment in innovation. Canada will soon have one of the most competitive business tax regimes in the world. By 2005, the average general rate of corporate taxation in Canada will be over 5 percentage points below the U.S. average rate (Chart 18). Our tax policies help businesses develop and adopt advanced technologies and remain ahead of key competitors.

Canada's low corporate tax rates, low capital gain inclusion rates, favourable treatment of employee stock options and special provisions for small businesses (including the rollover of capital gains on investments in small businesses

The Canadian Business Tax Advantage

- ***Large and medium-sized businesses:*** *Five-percentage-point lower average corporate tax rate in Canada than in the U.S. by 2005.*
- ***Small businesses:*** *Significantly lower corporate rates in Canada on income above $75 000.*
- ***Capital gains:*** *Two-percentage-point lower average top capital gains tax rate in Canada than the typical top capital gains tax rate in the U.S. The $500 000 lifetime capital gains exemption on small business shares has no equivalent in the U.S.*
- ***Research and Development:*** *A 20 percent research and development tax credit in Canada for all R&D expenditures compared to the U.S. 20 percent tax credit, which is only for incremental R&D. A 35 percent refundable tax credit available to smaller Canada-controlled private corporations has no equivalent in the U.S.*

Chart 18: Corporate Income and Capital Tax Rates in Canada and the U.S.



Note: Rates are based on changes announced to December 2001. Rates include the income tax rate equivalent of capital taxes.

Source: Department of Finance Canada, *Budget 2001*, 2001.

BEST COPY AVAILABLE

when the proceeds of disposition are reinvested in small businesses) provide an incentive to invest in innovation. Canada also has one of the most generous tax treatments of R&D expenditures in the OECD. These features of the Canadian business tax system combine to create a business advantage for Canada relative to its main competitor, the U.S.

Personal taxes also play a role in helping to attract and retain leaders, researchers and other highly qualified people from Canada and abroad. The government's tax reduction plan, which will reduce the personal income tax burden by 21 percent on average by 2004–05, assists in providing a more favourable environment in this regard.

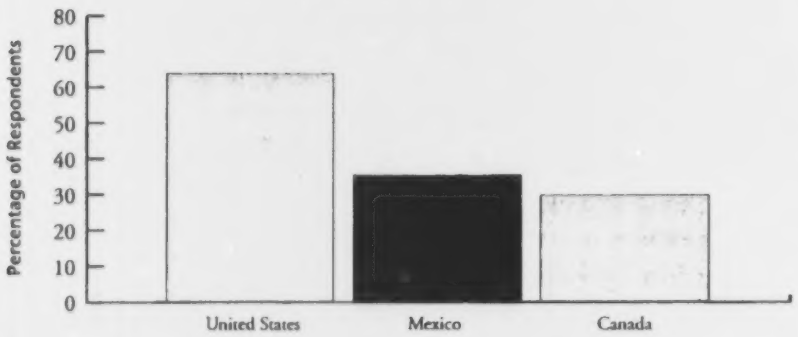
Sound tax policies also help make Canada more attractive to international investors, an important consideration as we compete to be viewed as a "location of choice" within North America.

BRANDING CANADA

Canada's innovation environment will improve if we achieve the goals and undertake the initiatives set out in this paper. However, ensuring we achieve and maintain the conditions for innovation success is not enough. In the global economy, investors and highly qualified people must be aware that Canada encourages and rewards innovation and risk taking. They must believe that they can achieve their innovation objectives in Canada.

Foreign investors generally rate Canada as an attractive location for investment. However, investment surveys often indicate that their impressions of other investment locations are more favourable (Chart 19).

Chart 19: Investment Intentions of Major Multinational Firms



Source: Global Business Policy Council, *FDI Confidence Index*, A.T. Kearney, Inc., June 1999, Volume 2, Issue 1.

© Photo courtesy of Technology Partnerships Canada

Branding campaigns can improve Canada's image among investors and highly qualified people by demonstrating our advantages. Raising Canada's profile would help secure the international recognition we need to be seen as one of the most innovative countries in the world.

Addressing the Innovation Environment Challenge

Canada's ability to innovate depends on public confidence in the safety and efficacy of new products, and stable and predictable regulatory regimes. With effective stewardship regimes and marketplace framework policies, innovation will thrive, bringing with it the solutions to many 21st-century problems and the wealth needed to attain those solutions. Canada must also be recognized internationally as an innovative country in order to attract the talent and capital required to fuel our ongoing growth.

GOALS, TARGETS AND PRIORITIES

The proposed goals, targets and federal priorities would give Canadians increased confidence to adopt innovations, encourage firms to invest in innovations, and attract the people and capital upon which innovation depends.

GOALS

- Address potential public and business confidence challenges before they develop.
- Ensure that Canada's stewardship regimes and marketplace framework policies are world-class.
- Improve incentives for innovation.
- Ensure that Canada is recognized as a leading innovative country.

TARGETS

- By 2004, fully implement the Council of Science and Technology Advisors' guidelines to ensure the effective use of science and technology in government decision making.
- By 2010, complete systematic expert reviews of Canada's most important stewardship regimes.
- Ensure Canada's business taxation regime continues to be competitive with those of other G-7 countries.
- By 2005, substantially improve Canada's ranking in international investment intention surveys.

GOVERNMENT OF CANADA PRIORITIES

1. **Ensure effective decision making for new and existing policies and regulatory priorities.**

   Priority: To benefit from the best science-based advice the country has to offer, protect the public interest and promote innovation, the Government of Canada will consider the following initiatives:

- Support a "Canadian Academies of Science" (a not-for-profit, arm's-length organization) to build on and complement the contribution of existing Canadian science organizations. The "Academies" could provide a source of credible, independent expert assessments on the sciences underlying pressing *new* issues and matters of public interest. It could support informed decision making by the public, government and businesses. The organization would widely disseminate the results of its assessments.
- Undertake systematic expert reviews of *existing* stewardship regimes through international benchmarking, and collaborate internationally to address shared challenges. New investments in government science (Priority 2 in Section 5) will further strengthen Canada's stewardship policies.

2. **Ensure that Canada's business taxation regime is internationally competitive.**

   Priority: Work with the provinces and territories to ensure that Canada's federal, provincial and territorial tax systems encourage and support innovation.

3. **Brand Canada as a location of choice.**

   Priority: The Government of Canada has committed to embarking on a sustained investment branding strategy. This could include Investment Team Canada missions and targeted promotional activities. Canada can attract foreign investment and highly qualified people by showcasing its highly educated and skilled work force, clusters of innovative firms and research institutions, tax policies, entrepreneurial spirit, and quality of life in communities across the country.

SOURCES OF COMPETITIVE ADVANTAGE ARE LOCALIZED

A paradox of the global, knowledge-based economy is that sources of competitive advantage tend to be localized. Communities and regions across Canada use their knowledge resources to create economic value, and it is in communities that the elements of the national innovation system come together.

In the past, Canada's economy was primarily dependent on natural resources and manufacturing, giving an advantage to communities close to natural resources or to major markets. In the knowledge-based economy, key assets are less geographically dependent. Knowledge and expertise can be developed and exploited anywhere. Communities can become magnets for investment and growth by creating a critical mass of entrepreneurship and innovative capabilities. By coordinating efforts, federal, provincial/territorial and municipal governments can work with the private, academic and voluntary sectors to build local capacity and unleash the full potential of communities across the country.

LARGE URBAN CENTRES

Innovation thrives in industrial clusters — internationally competitive growth centres. A common feature of clusters is the presence of one or more institutions devoted to R&D — universities, colleges, technical institutes, research hospitals, government laboratories or private sector facilities. Successful clusters have a strong and vibrant entrepreneurial base of networked and interdependent firms. Clusters accelerate the pace of innovation, attract investment, stimulate job creation and generate wealth.

Canada has several clusters in various stages of maturity. An industrial cluster can be regional (wine in Niagara); globally recognized (aerospace in Montréal); unique to one region (agricultural biotechnology in Saskatoon); cross regional boundaries (information and communications technologies in Ottawa, Toronto and Kitchener–Waterloo); historically rooted and well established (financial services in Toronto); or emerging (electronic commerce in Atlantic Canada).

BEST COPY AVAILABLE

An Established Canadian Cluster

Toronto and nearby Kitchener–Waterloo together form a technology cluster that is home to six research universities. The University of Toronto's electrical engineering program is ranked fourth in North America, and its computer engineering program is ranked fifth. The University of Waterloo is a leading source of information technology professionals in North America. Drawing on this talent pool, the Toronto/Kitchener–Waterloo cluster has developed into a major information and communications technology centre, with more than 2000 companies employing more than 100 000 people.

An Emerging Canadian Cluster

The agricultural biotechnology cluster in Saskatoon builds on the strengths of the University of Saskatchewan and the federal and provincial agencies in and immediately adjacent to Innovation Place, an industrial research park. Research and development is leading to innovations with important agricultural, environmental, health and transportation applications. The 2000 employees of the 100 organizations in Innovation Place contribute more than $195 million per year to the economy of Saskatoon.

A number of Canadian universities are key contributors to the research that fuels the development of clusters in their region. The Government of Canada, including the National Research Council Canada, has also played a key role in working with the private sector to stimulate the growth of clusters. Investments have been made in Nova Scotia (life sciences, information technologies), New Brunswick (e-commerce), and Newfoundland and Labrador (ocean technology). The 2001 budget announced further investments to encourage the development of clusters in Quebec (advanced aluminum technologies), Alberta (nanotechnology), Saskatchewan (crops for advanced human health), and British Columbia (fuel cell technologies), as well as initiatives in Ontario and Manitoba.

Cluster development is a complex, long-term undertaking that requires a unique and critical mass of existing community resources, as well as the commitment of many stakeholders and local champions. The ingredients for success include:

- leading-edge research and development capacity;
- knowledge-sharing infrastructure;
- technology transfer capacity;
- highly qualified people, including entrepreneurs, creators and strong managers;
- knowledgeable sources of venture or investment capital;
- industrial research parks, incubators, and other partnership-based research facilities;
- mentors to nurture new enterprises with strong management capabilities and entrepreneurial spirit;
- partnerships at many levels; and
- complementary government, academic and industrial contributions.

Canada can do a great deal more to stimulate the development of additional world-class clusters. Governments need to recognize the earliest signs of emerging clusters and provide community-based support. Each cluster and host community has unique strengths and challenges. The challenge for governments is to provide the right kind of support at the right time to create the conditions for self-sustaining growth. This support often takes the form of infrastructure to enable education, training, networking and research for which there are clear public benefits but no business case for private sector providers.

BEST COPY AVAILABLE

First Nation Innovation

Sixdion Inc. was founded in 1996 by the Six Nations of the Grand River. It is the only ISO 9002 registered information technology company located in a First Nations community in Canada. Its production facility in southwestern Ontario underwent a rigorous preparation, training and review process to meet this quality system standard. Sixdion provides information management services to a number of clients, including the Department of National Defence. It is committed to continuous improvement and to meeting world-class standards to benefit customers and employees.

MORE INNOVATIVE COMMUNITIES

Innovation should not be viewed as exclusively based in large urban centres. Many smaller communities, including rural and First Nations communities, have significant knowledge and entrepreneurial resources. They may, however, lack the networks, infrastructure, investment capital or shared vision to live up to their innovative potential. To address these types of challenges, the Government of Canada launched Community Futures Development Corporations, various regional development agency programs, the Canada Community Investment Plan and Smart Communities.

In 1995, the Government of Canada foresaw the importance of harnessing the potential of the Internet for Canadian society. Building on the advice of the Information Highway Advisory Council, the government developed a national vision known as "Connecting Canadians" — a strategy to make the information and knowledge infrastructure accessible to all Canadians. Six years later Canada is recognized as a world leader in connectivity.

Canada is well positioned to share knowledge across its economy and society, ranking second only to the U.S. in its overall level of connectedness. We have one of the world's most advanced telecommunications infrastructures, with considerable consumer choice. We also have some of the world's lowest prices and highest take-up rates for both basic and advanced services, such as high-speed Internet. For example, the cost for Internet access in Canada is among the lowest in the world, and according to the OECD, Canada has the highest broadband penetration among the G-7.[32]

32. OECD, DSTI/ICCP/TISP, *The Development of Broadband Access in OECD Countries*, 2001/2.

Canada's Information Highway Accomplishments

- *Connected all public schools and libraries to the Internet.*
- *Connected more than 10 000 voluntary organizations to the Internet.*
- *Delivered more than 300 000 computers to schools.*
- *Created CA*net 3, the world's fastest research Internet backbone.*
- *Launched 12 Smart Communities sites across Canada.*
- *Launched the geographic lane on the Internet through GeoConnections.*
- *Provided Canadians with affordable public Internet access at 8800 sites in more than 3800 communities (by March 31, 2002).*

BEST COPY AVAILABLE

In 2000, the government introduced the Infrastructure Canada Program and the Strategic Highway Infrastructure Program to sustain the nation's growth and quality of life in communities across the country. Budget 2001 recognized the need for additional community-based infrastructure support. The Government of Canada announced the creation of the Strategic Infrastructure Foundation and committed at least $2 billion to support projects in a range of areas, including highways, urban transportation and sewage treatment. Investments in infrastructure will make communities more productive and competitive in the long term.

Communities across the country, however, continue to face barriers to innovation. Businesses in many smaller communities can make a more significant contribution to innovation and, in the process, improve standards of living and quality of life in their communities. Community leaders need to mobilize stakeholders — businesses, local governments, universities, colleges, and voluntary organizations — to develop innovation strategies and harness knowledge resources for local benefit. Communities require access to existing government programs as well as new investments to implement their strategies and further support the development of their local capacity.

As part of this effort, Canada has a unique opportunity to increase its capacity to share knowledge, grow new local and virtual networks, develop new applications and improve Canadians' access to the benefits of the knowledge-based economy. The National Broadband Task Force noted that 75 percent of Canadians, but only 20 percent of communities, have access to high-speed computer networks.[33] It recommended that all Canadians gain access, given the economic and social benefits that this would enable (e-commerce, health, education, government on-line services, etc.).

Governments will need to work with the private sector to ensure that Canadians in both urban and rural communities can benefit from these developments. Rural, remote and First Nations communities are more in need of broadband than many other communities to bridge the gaps that exist in employment, business, learning, culture and health care. Broadband will provide the infrastructure needed to develop and deliver advanced applications and services that will bring greater economic and social benefits to these communities.

33. National Broadband Task Force, *The New National Dream: Networking the Nation for Broadband Access*, 2001.

Provincial Broadband Leadership

Many provinces and territories recognize the importance of access to broadband Internet. Alberta SuperNet provides affordable high-speed network connectivity and Internet access to all universities, school boards, libraries, hospitals, provincial government buildings and regional health authorities in the province. Connect Ontario will invest in broad-based partnership initiatives to create a high-tech network of 50 connected Smart Communities across Ontario by 2005. Connect Yukon is a Yukon government and NorthWestel partnership to develop territorial telecommunications. SmartLabrador is currently working with the federal government to set up 21 satellite or wireless telecentre sites.

BEST COPY AVAILABLE

GOALS, TARGETS AND PRIORITIES

The proposed goals, targets and federal priorities would help Canada to develop more world-class clusters of expertise and position more communities across the country to contribute to and benefit from innovation.

GOALS

- Governments need to work together to stimulate the creation of more clusters of innovation at the community level.
- Federal, provincial/territorial and municipal governments need to cooperate and supplement their current efforts to unleash the full innovation potential of communities across Canada. Efforts must be guided by community-based assessments of local strengths, weaknesses and opportunities.

TARGETS

- By 2010, develop at least 10 internationally recognized technology clusters.
- By 2010, significantly improve the innovative performance of communities across Canada.
- By 2005, ensure that high-speed broadband access is widely available to Canadian communities.

GOVERNMENT OF CANADA PRIORITIES

1. **Support the development of globally competitive industrial clusters.**

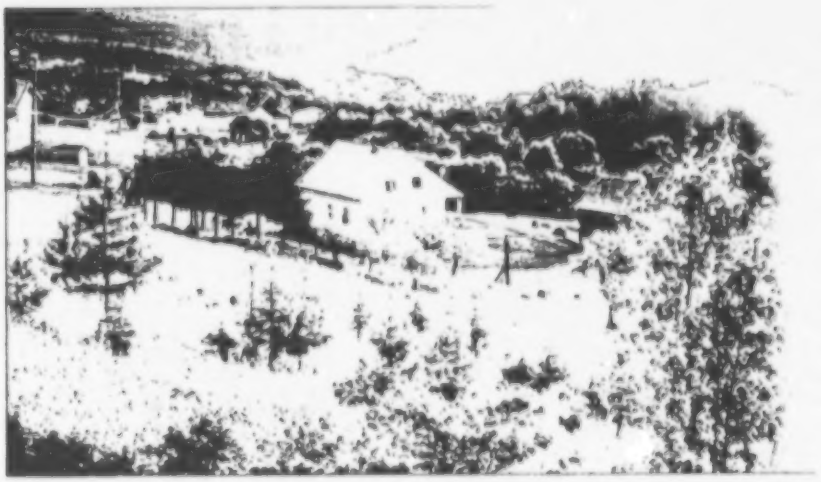
   Priority: The Government of Canada will accelerate community-based consultations already under way to develop technology clusters where Canada has the potential to develop world-class expertise, and identify and start more clusters. The government will invest in the necessary infrastructure, research and multi-stakeholder partnerships to realize Canada's potential to be globally competitive in such areas as biopharmaceuticals, photonics, nanotechnology, network security, high-speed computing, medical

diagnostic technologies, nutraceuticals, fuel cell technology, functional genomics, proteomics, and ocean and marine technologies. The 2001 federal budget announced a major contribution to this effort. The Government of Canada will provide an additional $110 million over three years for leading-edge technologies and to expand the National Research Council Canada's regional innovation initiative.

2. **Strengthen the innovation performance of communities.**

   Priority A: The Government of Canada will consider providing funding to smaller communities to enable them to develop innovation strategies tailored to their unique circumstances. Communities would be expected to engage local leaders from the academic, private and public sectors in formulating their innovation strategies. They would need an existing innovation base (e.g. a university, community college, research hospital, technical institute or government facility) to act as an anchor. Additional resources, drawing on existing and new programs, could be provided to implement successful community innovation strategies (e.g. to support entrepreneurial networks, local sources of financing, skills development, infrastructure).

   Priority B: As part of this effort, the Government of Canada will work with industry, the provinces and territories, communities and the public to advance a private sector solution to further the deployment of broadband, particularly for rural and remote areas. The 2001 budget set aside $105 million over three years to advance this objective.



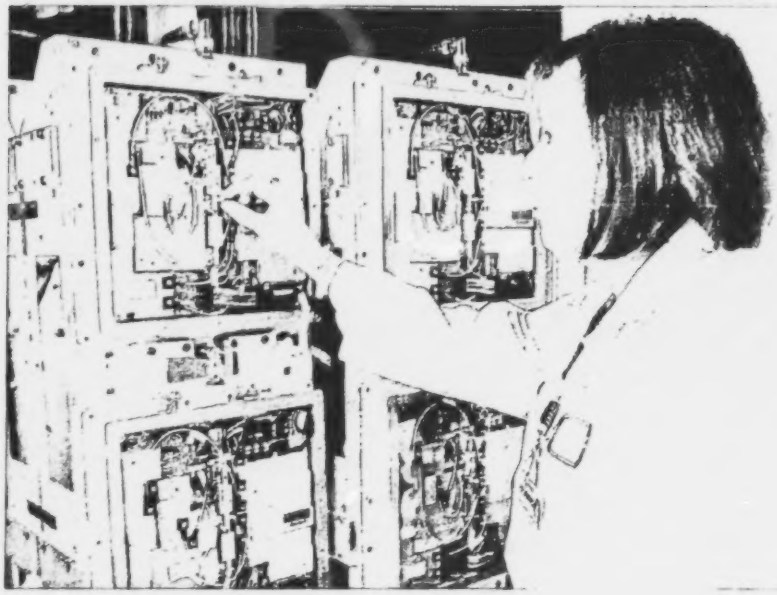
A CALL FOR ACTION

The innovation goals that Canada should strive to achieve, a number of which are identified in this paper, are ambitious but measurable. They are beyond the reach of any single institution, or group of stakeholders acting alone. Canadians must work together to achieve them, leveraging all our strengths and achievements in the process.

Small, medium-sized and large firms, universities and colleges across the country, research hospitals and technical institutes, provincial, territorial and municipal governments, First Nations, urban and rural communities, the voluntary sector and individual Canadians make important contributions to innovation. Innovations within these diverse organizations can contribute to wealth creation, better stewardship, improved governance and a stronger social fabric. Their ideas and initiatives underscore the importance of respecting mutual strengths and responsibilities. Their diversity highlights the need to recognize and understand the varied social, economic or jurisdictional circumstances that must be accommodated to create a culture of innovation across Canada. In this context, the Government of Canada invites Canadians to consider how they can bring their ideas, resources and talents to bear on the innovation challenge.

Over the coming months, the Government of Canada will engage provincial and territorial governments and business and academic stakeholders to develop, and contribute to, a national innovation strategy. We will listen to Canadians' views on the suggested priority areas for action by the Government of Canada. Should obstacles and constraints be identified, the Government of Canada is committed to working with all players in the innovation system to overcome them. Should new avenues of progress be suggested, the Government of Canada is committed to exploring them. If there are areas where the government can innovate to enable others to perform better, it will.

BEST COPY AVAILABLE



© Photo courtesy of Technology Partnerships Canada

THE BUSINESS COMMUNITY

Firms bring innovative products to market, adopt leading-edge business practices and apply best practice technologies. The private sector is at the centre of wealth-creating innovation. Governments and academic institutions help by performing and funding R&D, attracting and developing the best work force, getting the incentives right and ensuring that Canada's advantages are internationally recognized.

The Government of Canada will seek to develop joint priorities for action with the business community. There is a pressing need for the business sector to:

- increase investments in R&D;
- increase the share of private sector sales attributable to new innovations;
- innovate in all aspects of business practice including production, business processes, management, financing and marketing;
- develop new products and services in Canada for world markets;
- increase Canada's venture capital investments;
- identify critical skills needs;
- invest in learning and in becoming learning organizations;
- attract the best people from around the world;
- brand Canada abroad as one of the most innovative countries in the world; and
- network with universities, colleges, governments and other businesses to develop new and existing clusters where potential exists.

PROVINCIAL AND TERRITORIAL GOVERNMENTS

To make Canada more innovative, we need more people with the ability to learn throughout their careers. Public investments in our research base must increase. Universities require strong provincial government support for their teaching and community mandates. The innovation environment within which businesses work is created by all levels of government. Policies that affect the innovation environment — stewardship, tax and investment promotion — should promote public and business confidence.

The Government of Canada will work with provincial and territorial governments to build on the outcome of the successful meeting of Ministers of Science and Technology in September 2001. Ministers agreed on the goal of making Canada one of the most innovative countries in the world, while recognizing that different parts of the country will require different approaches and that success will require sustained effort. We will pursue the principles agreed to at that meeting and seek out opportunities to:

- increase cooperation and complementarity of policies, programs and services, while respecting other governments' areas of jurisdiction;
- attract, retain and provide meaningful opportunities to highly qualified people from around the world;
- improve the innovation environment;
- work together on best practices in stewardship and promote innovation;
- develop measurable and complementary innovation targets;
- improve the innovation performance of communities; and
- facilitate the efficient movement of goods, services and labour in the Canadian marketplace.

UNIVERSITIES AND COLLEGES

Canada depends on universities and colleges for research and our supply of highly qualified people. We will need more graduates with research-based (Master's and PhD) degrees, and not just from our largest universities. While few universities excel in all disciplines, none can afford to be less than excellent in some. Pressures for specialization and depth will grow as global competition increases. This will be particularly true for smaller universities. Our research agenda, which is solidly based in curiosity-driven inquiry, must increasingly contribute to the economic and social well-being of Canadians.

Recognizing the role of educational institutions in the national innovation system, the Government of Canada will discuss how universities, colleges and health institutions can:

- ensure that teaching and research capacities are maintained and expanded in the face of faculty retirements and worldwide competition for talent;
- specialize in research niches as a means of developing nationally and globally recognized expertise;
- increase the supply of highly qualified people with the skills required by employers; and
- at least triple key commercialization performance outcomes — this will require the development of innovation strategies, clear intellectual property policies, greater efforts to train technology transfer practitioners and regular reporting on commercialization results.

© Photo courtesy of Canada's SchoolNet

SECTION 10

BUILDING A MORE INNOVATIVE CANADA: NEXT STEPS

Achieving Excellence: Investing in People, Knowledge and Opportunity describes the economic and social context surrounding innovation. It offers up for discussion goals and targets to improve Canada's innovative performance. It outlines actions that the Government of Canada could take. All stakeholders are making important contributions to innovation. We must now join efforts to build a leading economy that is one of the most innovative in the world.

As a first step, the Government of Canada has held and will continue to hold discussions with provincial and territorial governments. They are important contributors to Canada's overall innovation effort and are key allies in ensuring that we deliver on our commitment to improve Canada's innovation performance.

The innovation message needs to be taken further than simply between levels of government. Many in the academic and business communities are already well aware of Canada's innovation challenges. The Government of Canada will reach out to these stakeholders and actively participate with them in the development of a national innovation strategy. The government will also show Canadians how they, as individuals, fit in the innovation agenda, and how they can improve their standard of living.

We need to continuously monitor and assess Canada's innovation performance, both in absolute terms and in relation to our competitors. To this end, the Government of Canada will work with

Photo courtesy of Syncrude Canada Ltd.

BEST COPY AVAILABLE

Photos courtesy of: Canada's SchoolNet, National Research Council Canada, Hibernia Management and Development Company Ltd., and Toronto Tourism.

stakeholders to develop a set of indicators, some of which have been proposed in this paper. These will be tracked over time and will be used to report to Canadians on progress.

A strong economy driven by innovation is necessary to address our security concerns, tackle climate change and other global challenges, improve the health of Canadians, and create opportunities for all. Our standard of living during the next decade will depend on how innovative we are — as firms, governments, education and research institutions, communities and voluntary organizations.

Canada has many economic, social and cultural strengths on which to build. We have many opportunities ahead. Our challenge now is to work together to become, and to be seen as, one of the most innovative nations in the world.

APPENDIX A

ACHIEVING EXCELLENCE: INVESTING IN PEOPLE, KNOWLEDGE AND OPPORTUNITY

Achieving Excellence: Investing in People, Knowledge and Opportunity is a blueprint for building a stronger, more competitive economy in Canada. It provides an assessment of Canada's innovation performance, proposes national targets to guide the efforts of Canadians over the next decade, and identifies a number of areas where the Government of Canada can act. This paper proposes goals and targets in three key areas — knowledge performance, skills and the innovation environment — as well as for addressing challenges at the community level. In addition, the Government of Canada has identified specific federal priorities, which would constitute its contribution to what must ultimately be a sustained national effort.

ADDRESSING THE KNOWLEDGE PERFORMANCE CHALLENGE

The Government of Canada proposes the following goals, targets and federal priorities to help more firms develop and commercialize leading-edge innovations.

GOALS

- Vastly increase public and private investments in knowledge infrastructure to improve Canada's R&D performance.
- Ensure that a growing number of firms benefit from the commercial application of knowledge.

TARGETS

- By 2010, rank among the top five countries in the world in terms of R&D performance.
- By 2010, at least double the Government of Canada's current investments in R&D.
- By 2010, rank among world leaders in the share of private sector sales attributable to new innovations.
- By 2010, raise venture capital investments per capita to prevailing U.S. levels.

GOVERNMENT OF CANADA PRIORITIES

1. **Address key challenges for the university research environment.**

   The Government of Canada has committed to implementing the following initiatives:

- **Support the indirect costs of university research.** Contribute to a portion of the indirect costs of federally supported research, taking into account the particular situation of smaller universities.

Reproduced with Permission from Health Canada, 2002
© Minister of Public Works and Government Services Canada, 2002

- **Leverage the commercialization potential of publicly funded academic research.** Support academic institutions in identifying intellectual property with commercial potential and forging partnerships with the private sector to commercialize research results.

- **Provide internationally competitive research opportunities in Canada.** Increase support to the granting councils to enable them to award more research grants at higher funding levels.

2. **Renew the Government of Canada's science and technology capacity to respond to emerging public policy, stewardship and economic challenges and opportunities.**

- The Government of Canada will consider a collaborative approach to investing in research in order to focus federal capacity on emerging science-based issues and opportunities. The government would build collaborative networks across government departments, universities, non-government organizations and the private sector.

3. **Encourage innovation and the commercialization of knowledge in the private sector.**

- **Provide greater incentives for the commercialization of world-first innovations.** The Government of Canada will consider increased support for established commercialization programs that target investments in biotechnology, information and communications technologies, sustainable energy, mining and forestry, advanced materials and manufacturing, aquaculture and eco-efficiency.

- **Provide more incentives to small and medium-sized enterprises (SMEs) to adopt and develop leading-edge innovations.** The Government of Canada will consider providing support to the National Research Council Canada's Industrial Research Assistance Program to help Canadian SMEs assess and access global technology, form international R&D alliances, and establish international technology-based ventures.

- **Reward Canada's innovators.** The Government of Canada will consider implementing a new and prestigious national award, given annually, to recognize internationally competitive innovators in Canada's private sector.

- **Increase the supply of venture capital in Canada.** The Business Development Bank of Canada will pool the assets of various partners, invest these proceeds in smaller, specialized venture capital funds and manage the portfolio on behalf of its limited partners.

ADDRESSING THE SKILLS CHALLENGE

The Government of Canada proposes the following goals, targets and federal priorities to develop, attract and retain the highly qualified people required to fuel Canada's innovation performance.

GOALS

- Develop the most skilled and talented labour force in the world.
- Ensure that Canada receives the skilled immigrants it needs and helps immigrants to achieve their full potential in the Canadian labour market and society.

TARGETS

- Through to 2010, increase the admission of Master's and PhD students at Canadian universities by an average of 5 percent per year.
- By 2002, implement the new *Immigration and Refugee Protection Act* and regulations.
- By 2004, significantly improve Canada's performance in the recruitment of foreign talent, including foreign students, by means of both the permanent immigrant and the temporary foreign workers programs.
- Over the next five years, increase the number of adults pursuing learning opportunities by 1 million.

GOVERNMENT OF CANADA PRIORITIES

1. **Produce new graduates.**

   The Government of Canada will consider the following initiatives:

- Provide financial incentives to students registered in graduate studies programs, and double the number of Master's and Doctoral fellowships and scholarships awarded by the federal granting councils.
- Create a world-class scholarship program of the same prestige and scope as the Rhodes Scholarship; support and facilitate a coordinated international student recruitment strategy led by Canadian universities; and implement changes to immigration policies and procedures to facilitate the retention of international students.
- Establish a cooperative research program to support graduate and post-graduate students and, in special circumstances, undergraduates, wishing to combine formal academic training with extensive applied research experience in a work setting.

2. **Modernize the Canadian immigration system.**

   The Government of Canada has committed to:

- Maintain higher immigration levels and work toward increasing the number of highly skilled workers.
- Expand the capacity, agility and presence of the domestic and overseas immigration delivery system to offer competitive service standards for skilled workers, both permanent and temporary.
- Brand Canada as a destination of choice for skilled workers.
- Use a redesigned temporary foreign worker program and expanded provincial nominee agreements to facilitate the entry of highly skilled workers, and to ensure that the benefits of immigration are more evenly distributed across the country.

BEST COPY AVAILABLE

ADDRESSING THE INNOVATION ENVIRONMENT CHALLENGE

The Government of Canada proposes the following goals, targets and federal priorities to protect Canadians and encourage them to adopt innovations; encourage firms to invest in innovations; and attract the people and capital upon which innovation depends.

GOALS

- Address potential public and business confidence challenges before they develop.
- Ensure that Canada's stewardship regimes and marketplace framework policies are world-class.
- Improve incentives for innovation.
- Ensure that Canada is recognized as a leading innovative country.

TARGETS

- By 2004, fully implement the Council of Science and Technology Advisors' guidelines to ensure the effective use of science and technology in government decision making.
- By 2010, complete systematic expert reviews of Canada's most important stewardship regimes.
- Ensure Canada's business taxation regime continues to be competitive with those of other G-7 countries.
- By 2005, substantially improve Canada's ranking in international investment intention surveys.

GOVERNMENT OF CANADA PRIORITIES

1. **Ensure effective decision making for new and existing policies and regulatory priorities.**

   The Government of Canada will consider the following initiatives:

- Support a "Canadian Academies of Science" to build on and complement the contribution of existing Canadian science organizations.
- Undertake systematic expert reviews of existing stewardship regimes through international benchmarking, and collaborate internationally to address shared challenges.

2. **Ensure that Canada's business taxation regime is internationally competitive.**

- The Government of Canada will work with the provinces and territories to ensure that Canada's federal, provincial and territorial tax systems encourage and support innovation.

3. **Brand Canada as a location of choice.**

- The Government of Canada has committed to a sustained investment branding strategy. This could include Investment Team Canada missions and targeted promotional activities.

BEST COPY AVAILABLE

ADDRESSING COMMUNITY-BASED INNOVATION CHALLENGES

The Government of Canada proposes the following goals, targets and federal priorities to support innovation in communities across the country.

GOALS

- Governments at all levels work together to stimulate the creation of more clusters of innovation at the community level.
- Federal, provincial/territorial and municipal governments cooperate and supplement their current efforts to unleash the full innovation potential of communities across Canada, guided by community-based assessments of local strengths, weaknesses and opportunities.

TARGETS

- By 2010, develop at least 10 internationally recognized technology clusters.
- By 2010, significantly improve the innovation performance of communities across Canada.
- By 2005, ensure that high-speed broadband access is widely available to Canadian communities.

GOVERNMENT OF CANADA PRIORITIES

1. **Support the development of globally competitive industrial clusters.**

- The Government of Canada will accelerate community-based consultations already under way to develop technology clusters where Canada has the potential to develop world-class expertise, and identify and start more clusters.

2. **Strengthen the innovation performance of communities.**

- The Government of Canada will consider providing funding to smaller communities to enable them to develop innovation strategies tailored to their unique circumstances. Communities would be expected to engage local leaders from the academic, private and public sectors in formulating their innovation strategies. Additional resources, drawing on existing and new programs, could be provided to implement successful community innovation strategies.
- As part of this effort, the Government of Canada will work with industry, the provinces and territories, communities and the public to advance a private sector solution to further the deployment of broadband, particularly for rural and remote areas.

BEST COPY AVAILABLE

INNOVATION STRATEGIES IN OTHER COUNTRIES

Industrialized countries the world over have recognized the importance of innovation in improving their standard of living and quality of life. Some, such as the U.K. and Australia, have articulated formal national strategies to improve their performance. Others have not launched formal strategies but support innovation vigorously, and are top performers in comparison to their competitors. The United States and Sweden are representative of this group. This appendix presents a brief description of these countries' approaches to innovation as expressed in national innovation strategies or as is apparent from current policies.

UNITED KINGDOM

The U.K.'s most recent innovation strategy was released in 2001 (*A White Paper on Enterprise, Skills and Innovation: Opportunity for All In a World of Change*). The strategy's focus is on a set of initiatives and actions in five key areas: developing a more highly skilled work force; building strong regions and communities; spreading the benefits of new research and technologies and developing new world-beating industries; ensuring markets operate effectively and fairly; and strengthening Britain's position in European and global trade. The strategy also establishes a benchmarking process to assess progress.

The U.K.'s innovation strategy places great emphasis on accelerating the development of the next generation of communication infrastructure. R&D support has been targeted at funding selected technologies (genomics, basic technologies and e-science) and also at developing policies that encourage investment in R&D by the private sector. With respect to the work force, the strategy focuses on lifelong learning and continuous re-skilling by providing a framework in which individuals and employers can invest in skills. All areas of the strategy are sensitive to regional and community development concerns.

BEST COPY AVAILABLE

AUSTRALIA

Australia's innovation strategy, *Backing Australia's Ability, an Innovation Action Plan for the Future*, focuses on the government's commitment to three key elements in the innovation process: strengthening Australia's ability to generate ideas and undertake research; accelerating the commercial application of these ideas; and developing and retaining Australian skills. The strategy focuses on providing support for internationally competitive research, infrastructure, incentives for R&D investment, and assistance to firms in the commercialization process. With respect to skills, Australia proposes further investments in post-secondary institutions and amendments to the immigration process. The government is also commited to reviewing regulatory frameworks and strengthening the country's intellectual property regimes.

UNITED STATES

Although the United States does not have a formally articulated innovation strategy, it is, by almost all measures, the most innovative country in the world. Key initiatives include funding basic research in universities, ensuring graduate-level educational opportunities for qualified students, funding federal government laboratories and conducting large amounts of defence research. Significant efforts are made to coordinate, but not centralize, federal activity in these areas. The U.S. has an effective framework for competition, and is now focusing on expanding this framework to international markets through trade agreements and negotiations.

The U.S. is building on its research base, one of the best in the world, in order to provide the necessary frameworks and infrastructure to effectively enable the diffusion of knowledge. The development of partnerships, testbeds, analytical tools, technical support and standardized testing protocols all serve to provide a sound base upon which firms can take decisions with respect to the adoption of new, innovative technologies. R&D investments by the government have increased in recent years. The U.S. government has also committed to increasing its investment in infrastructure for schools, expanding college aid, providing training programs in the workplace and assisting communities in need. In order to help the business community have access to an increased supply of highly qualified people, the government recently revised its immigration policies to augment the number of working visas provided.

SWEDEN

Although Sweden has not formally presented a strategy on innovation, its policies demonstrate a strong commitment to innovation. Sweden recognizes that knowledge diffusion is a crucial link between knowledge generation and commercialization. It encourages the diffusion of knowledge, which also facilitates the effective integration of regional programs into a more national approach. Sweden's approach to skills is directed at providing development and employment opportunities for the existing work force.

LIST OF CHARTS AND TABLES

Chart 1:	Net Change in Employment in Canada, 1990–2000	5
Chart 2:	GDP per Capita	13
Chart 3:	Standard of Living and Productivity	14
Chart 4:	Labour Productivity, 1999	15
Chart 5:	Canada's Innovation Performance — Standing relative to the G–7, 1999	16
Chart 6:	Canada's Innovation Performance — Average annual rate of growth, 1981–99	18
Chart 7:	Innovation Among Manufacturing Firms	36
Chart 8:	Share of Sales from New or Improved Products	37
Chart 9:	Canadian Manufacturing Firms Using More Than Five Advanced Technologies	38
Chart 10:	E-Commerce Sales as Percentage of Total Sales, 2000	39
Chart 11:	Share of Industry-Funded R&D Performed in Universities, 2000	41
Chart 12:	Technological Alliances Between Firms, 1989–98	49
Chart 13:	Canadian Venture Capital Trends	49
Chart 14:	Percentage of the Population Aged 25 to 64 That Has Completed Post-Secondary Education, 1999	55
Chart 15:	Main Reasons for Investing in Canada	55
Chart 16:	Percentage of Employed Adults Aged 25 to 54 Participating in Employer-Sponsored Formal Job-Related Training, 1995	59
Chart 17:	Regulatory Barriers to Entrepreneurship, 1998	63
Chart 18:	Corporate Income and Capital Tax Rates in Canada and the U.S.	67
Chart 19:	Investment Intentions of Major Multinational Firms	68
Table A:	Canada's Performance, 2001–02	17
Table B:	Canada's Innovation Environment — Canada/U.S. Rankings, 2001	17

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

NOTICE

Reproduction Basis

☐ This document is covered by a signed "Reproduction Release (Blanket)" form (on file within the ERIC system), encompassing all or classes of documents from its source organization and, therefore, does not require a "Specific Document" Release form.

☑ This document is Federally-funded, or carries its own permission to reproduce, or is otherwise in the public domain and, therefore, may be reproduced by ERIC without a signed Reproduction Release form (either "Specific Document" or "Blanket").